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Canadian Cancer Statistics 1996



Produced by:
National Cancer Institute of Canada
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Health Canada

Canadian Cancer Statistics

GOVERNMENT DOCUMENTS

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The production and distribution of the monograph is the result of collaboration among all these groups.

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INTRODUCTION

This monograph is published by the National Cancer Institute of Canada in collaboration with Statistics Canada, Health Canada and provincial/territorial cancer registries. It is part of an annual series that began publication in 1987.

The main purpose of the publication is to provide health professionals, researchers, and policymakers with detailed information regarding the incidence and mortality of the most common types of cancer by age, sex, time period, and province. It is hoped that these data will stimulate new research and assist decision-making and priority-setting processes at the individual, community, provincial, and national levels. The monograph is also used by educators, the media, and by members of the public with an interest in cancer.

Each year the monograph contains information on cancer incidence and mortality by age, sex, time period and province. In addition, one or more Special Topics are usually included. This year, the Special Topics include prostate cancer, the economic burden of cancer, and an evaluation of previously reported estimates. In recent years the Special Topics have included: prevalence of cancer and colorectal cancer (1995); breast cancer in women (1993); survival rates in several provinces (1991-1993, 1995); cancer in aboriginal populations (1991); smoking prevalence and lung cancer (1991); age-specific trends in selected sites among women (1990); cancer mortality by income level (1990); and the economic burden of cancer (1990).

Information on cancer incidence and mortality comes from the provincial and territorial cancer registries and offices of vital statistics, which send their data to Statistics Canada for compilation at the national level. The process of collecting complete information about cancer cases in each province and then compiling this information at the national level results in a considerable delay before reliable information for a particular year is available for all of Canada. This report contains actual rates and frequencies up to the most recent year for which complete data are available (1991 for incidence; 1993 for mortality), and in addition, estimated values for years up to 1996. The estimates are made in the following way: first, time trends in the known rates are examined; second, these trends are projected to the present time to obtain current rate estimates; and third, these rate estimates for the current year are applied to current population estimates.

Note: The statistical methodology used for this edition is the same as that used in 1995 but differs from that used in years 1987 to 1994 primarily because the standardization of incidence and mortality rates is now based on the 1991 Canadian population rather than the World Standard Population. The higher rates observed with this methodology do not mean that beginning from 1995, there has been a sudden increase in the number of cancer cases and deaths. It reflects the fact that rates are now standardized to the 1991 Canadian population rather than the World Standard Population. The Canadian population has a much higher proportion of people in the older age groups, in which cancer is much more common. The steering committee felt that standardization using the Canadian population would be more relevant and useful to those concerned with cancer in Canada. **It is not appropriate to compare age-standardized rates presented herein to those presented prior to 1995.**

Details of the statistical methods used to produce the projections are described in the Appendix I: Methodology. **It is important to emphasize that the figures provided for 1996 are estimates, rather than actual data.**

The statistics contained herein refer to all types of cancer, defined according to a standardized classification system that is used worldwide. As is customary in reports from cancer registries, the statistics exclude skin cancers other than melanoma. Benign tumours and carcinoma in-situ are also excluded. To better interpret trends in lymphoid cancers, these are now presented separately as non-Hodgkin's lymphoma, Hodgkin's disease and multiple myeloma. Details of how cancer sites were classified and definitions of technical terms are provided in the *Glossary*.

Individuals who require additional information can refer to the section entitled "*For Further Information*", which indicates how to contact the various agencies involved, including Statistics Canada, Health Canada, the Canadian Cancer Society, National Cancer Institute of Canada, and provincial and territorial cancer agencies. Related information can also be found in other publications, including: reports from provincial and territorial cancer registries; *Cancer in Canada* and *Health Reports*, published by Statistics Canada; *Chronic Diseases in Canada*, published by Health Canada; *Cancer Incidence in North America*, published by the North American Association of Central Cancer Registries; *Cancer Incidence in Five Continents*, published by the International Agency for Research on Cancer; and a collaborative monograph titled *The Making of the Canadian Cancer Registry*.

The development of this publication over the years has benefited considerably from the comments and suggestions of readers. The Steering Committee appreciates and welcomes such comments, including ideas on how the report can be improved (an evaluation form is included on the final page of the report).

HIGHLIGHTS

Current Incidence and Mortality

- An estimated 129,200 new cases of cancer and 61,800 deaths from cancer will occur in Canada in 1996.
- In 1996, the most frequently diagnosed cancers will continue to be breast cancer for women and prostate cancer for men.
- Three types of cancer account for more than 50% of new cases of cancer. Among women these are breast, colorectal and lung cancers, and among men these are prostate, lung and colorectal cancers.
- Lung cancer continues as the leading cause of cancer death for both Canadian women and men in 1996. Lung cancer is now the second most frequently diagnosed cancer in both men and women. One-third of cancer deaths in men and one-fifth in women are due to lung cancer. Lung cancer deaths now exceed breast cancer deaths in women aged 50-59 as well as 60-69 and 70-79. Lung cancer remains the leading cause of cancer deaths in all age groups among adult men.
- While the numbers of new cases of cancer and the numbers of deaths due to cancer are increasing every year, most of this increase is attributable to changes in the size and age structure of the Canadian population.

Trends in Cancer Age-Standardized Incidence and Mortality

- Since the mid-1980s, incidence and mortality rates for lung cancer in men have levelled off and since the late 1980s have started to decline, likely reflecting the fall in tobacco consumption among men that began in the 1960s. In contrast, lung cancer incidence and mortality rates for women have continued their steady climb.
- Among Canadian women, the incidence and mortality rates for cancers of the cervix, body of the uterus and ovaries have continued to decline steadily.
- The incidence of breast cancer continues to rise, with most of the increase occurring among women aged 60 and more. Mortality rates for breast cancer have declined slightly in the past decade, particularly since 1990, primarily among women aged 59 and under. The rate for 1993 is the lowest recorded during the period 1969-1993.
- Among women, incidence and mortality rates for all cancers combined have been relatively stable since 1984. However, among men, incidence rates for all cancers combined have risen slightly due to the sharp increase observed for prostate cancer.

- Cancer mortality rates for men appear to have peaked and are now gradually declining due to decreasing mortality rates for lung, colorectal and other cancers.
- Incidence and mortality rates for colorectal cancer continue to decline, with mortality rates decreasing more rapidly among both men and women. These trends may reflect improvements in the Canadian diet as well as improvements in diagnosis and treatment.

Age and Sex Distribution of Cancer

- Cancer is primarily a disease of older Canadians, with 45% of new cancer cases and 56% of deaths due to cancer occurring among those who are at least 70 years old.
- Since 1984, increases in cancer incidence occurred mainly in Canadians aged 60-79.
- Steady declines in cancer mortality rates are continuing among Canadian men and women in all age groups under 60 years. The decline has been particularly significant for Canadians aged 0-19 years. Among 50-59-year-old men and women the decline has occurred primarily since the mid to late 1980s. Among older Canadians, mortality rates have increased among women aged 60-79, but have remained stable for men aged 60 and over and women aged 80 and over.

Probability of Developing/Dying from Cancer

- Over their lifetimes 1 in 9 women will develop breast cancer, mainly after age 50. 1 in 16 will develop colorectal cancer and 1 in 21 will develop lung cancer. One in 25 will die from breast cancer and 1 in 24 will die from lung cancer.
- Among men, approximately 1 in 9 will develop prostate cancer, mainly after age 70. Colorectal cancer will affect 1 in 15 men, and 1 in 11 will develop lung cancer. 1 in 12 will die from lung cancer, and 1 in 27 will die from prostate cancer.

Potential Years of Life Lost due to Cancer

- A total of 873,000 potential years of life lost (PYLL) for men and women in Canada were attributable to cancer in 1993. Cancer is the leading cause of premature mortality. Lung cancer alone accounted for more than 26% of PYLL.
- For the first time, lung cancer and breast cancer are equally important as causes of potential years of life lost among women. Each disease results in the loss of 94,000 potential years of life.

Cancer in Children Aged 0-14 Years

- Leukemia remains the most common of the childhood cancers, followed by cancers of the brain and spinal cord and lymphomas. Because many childhood tumours now have a relatively good prognosis, survival into adulthood is possible for many children who previously might have died at a young age.

Prostate Cancer

- The incidence of prostate cancer has surpassed that of lung cancer, making this malignancy the most commonly diagnosed cancer in Canadian men. It ranks second to lung cancer as a cause of cancer death in men. Age-specific incidence and mortality rates have increased since 1969, particularly in older men. The age-standardized incidence rates have shown a sudden substantial increase since 1990. It is generally accepted that this recent increase results largely from early detection techniques.
- The age-standardized mortality rate for prostate cancer is increasing, but not as dramatically as the incidence rate.

Direct Costs of Cancer in Canada

- An estimated \$68 billion dollars were spent on the direct costs of illness in Canada in 1993. Of this, cancer accounted for at least \$3.5 billion dollars. In terms of direct cost, cancer ranks 4th behind cardiovascular, respiratory, and digestive diseases.
- Given the large number of cases and the high costs associated with cancer in Canada, and given that these will continue to increase as the population ages and grows, further developments in cancer control are needed, including those that can achieve a reduction in the use of tobacco products.

Evaluation of Cancer Estimates: 1987-1991

- A comparison between annual estimates reported in previous editions of this publication and the actual values that were ultimately observed indicated very good agreement, with deviations of only 1-3% between estimated and actual values for all cancers combined.

CURRENT INCIDENCE AND MORTALITY

Three measures of the importance of different forms of cancer in Canada in 1996 are shown in Table 1. **Incidence** is expressed as the number of new cases of a given type of cancer diagnosed per year. **Mortality** is expressed as the number of deaths attributed to a particular type of cancer during the year. The **deaths to cases ratio** (or the number of deaths divided by the number of new cases) is a crude indicator of disease severity. The closer a value is to 1.0, the poorer the prognosis for that cancer. Frequencies listed in Tables 1 to 7 are **estimates** based on extrapolations of trends in cancer incidence, mortality and population data since 1984, and are rounded to the nearest 5, 10, 50 or 100. Readers requiring more accurate actual data, or information on less common sites of cancer, may refer to Appendix Tables 1 and 2 or to source publications.^{2,21,26} Some problems inherent in using the above statistics are considered below.

Sources of Data

Incidence figures collected by provincial and territorial cancer registries are reported to the Canadian Cancer Registry (CCR) maintained by Statistics Canada, beginning with cases diagnosed as of 1992. The patient-oriented CCR has evolved from the event-oriented National Cancer Incidence Reporting System that collected data from 1969-1991. The new CCR is regularly updated, is internally linked to track patients diagnosed with tumours in more than one province, and its records will be linked to death certificates. Data from these series are published annually by Statistics Canada in *Cancer in Canada*²⁶ and by the North American Association of Central Cancer Registries in *Cancer Incidence in North America*¹⁰ every five years in the series entitled *Cancer Incidence in Five Continents*, produced by the International Agency for Research on Cancer,²¹ and in occasional reports.²

Every effort is made to count all newly diagnosed cases of cancer among people who reside in a given province at the time of diagnosis, and to accurately and consistently record for each case the site and histological type of cancer from pathology and other records, according to definitions in the CCR Data Dictionary. Cancer sites included in this report are defined according to the groupings listed in the *Glossary*. Although the provincial cancer registries strive, through the Canadian Council of Cancer Registries and its Standing Committee on Data Quality, to achieve uniformity in defining and classifying new cases, reporting procedures may still vary across the country. This is particularly true for skin cancer (other than melanoma), which occurs frequently but is difficult to register completely because it is usually treated successfully without requiring hospitalization or the review of a pathologic specimen. For this reason, **all tables in this monograph exclude the estimated 62,500 cases of non-melanoma skin cancer for Canada in 1996.*** Registration levels for cancer have also become more comparable across the country, particularly since 1981 but also continuing into the mid-1980s, as registries standardized their procedures for case-finding, including links to provincial mortality data.

* The number of new cases of non-melanoma skin cancer is estimated using incidence rates from the cancer registry in British Columbia, which is considered to have the most complete data.

Cancer mortality statistics are derived from death records maintained by the provincial and territorial registrars of vital statistics for persons resident in that province at the time of death. Cancer deaths are those attributed to some form of cancer as the underlying cause of death by the certifying physician. Although these procedures have been standardized both nationally and internationally, some lack of uniformity is inevitable. The description of the type of cancer provided on the death certificate is usually less precise than that obtained by the cancer registries from hospital and pathology records. Also, cancer deaths occurring in a given year will usually be the result of cancers diagnosed in previous years.

Estimates for Cancer Incidence and Mortality, Canada, 1996

An estimated 129,200 new cases of cancer and 61,800 deaths from cancer will occur in Canada in 1996. Men outnumber women for both new cases and deaths, as shown by sex ratios (male:female) of 1.1 for incidence and 1.2 for mortality (Table 1).

Three types of cancer account for at least 50% of the new cases in each sex: prostate, lung, and colorectal cancers in males, and breast, colorectal, and lung cancers in females. A third of the cancer deaths in men, and one-fifth in women, are due to lung cancer alone (Figures 1.1 and 1.2).

Lung cancer will continue as the leading cause of cancer death among Canadian women in 1996, accounting for an estimated 6,000 deaths compared to the 5,300 deaths expected for breast cancer. This results from the rapid increase in lung cancer mortality rates among women over the past decade, while breast cancer mortality has declined slightly. Lung cancer *incidence* among women also continues to rise. With an estimated 7,600 new cases, lung cancer is now the second-leading form of cancer incidence, just ahead of the 7,500 new cases expected for colorectal cancer, which now becomes the third-ranked cancer among Canadian women.

Among Canadian men in 1996, prostate cancer will continue as the leading form of cancer incidence, with an estimated 18,200 newly diagnosed cases compared to 12,400 lung cancers. This reflects in part the rapid increase in the numbers of prostate cancers being detected in all provinces across Canada as a result of the continued widespread rise in the use of earlier detection techniques. Nevertheless, lung cancer will remain the leading cause of cancer death among Canadian men in 1996; the estimated 11,000 lung cancer deaths far exceed the 4,200 deaths due to prostate cancer, the second leading cause of male cancer death.

Deaths to Cases Ratio

The ratio of deaths to new cases, at 48% overall, is slightly greater in males than females. Based on these ratios, the cancer sites listed in Table 1 can be classified into three groups: those with a very good prognosis (a ratio of 30% or less – breast, prostate, bladder, melanoma, body of the uterus, cervix, Hodgkin's disease and testis); those with a fairly good prognosis (a ratio greater than 30% but less than 50% – colorectal, non-Hodgkin's lymphoma, kidney, oral, larynx); and those with a poor prognosis (ratio greater than 60% – lung, adult leukemia, stomach, pancreas, ovary, brain and multiple myeloma).

These ratios are generally similar for males and females within each site. The overall ratio of deaths to new cases of 48% would be considerably lower if non-melanoma skin cancer cases were included, as this disease is readily cured.

Table 1
Estimated New Cases and Deaths for Selected Cancer Sites by Sex, Canada, 1996

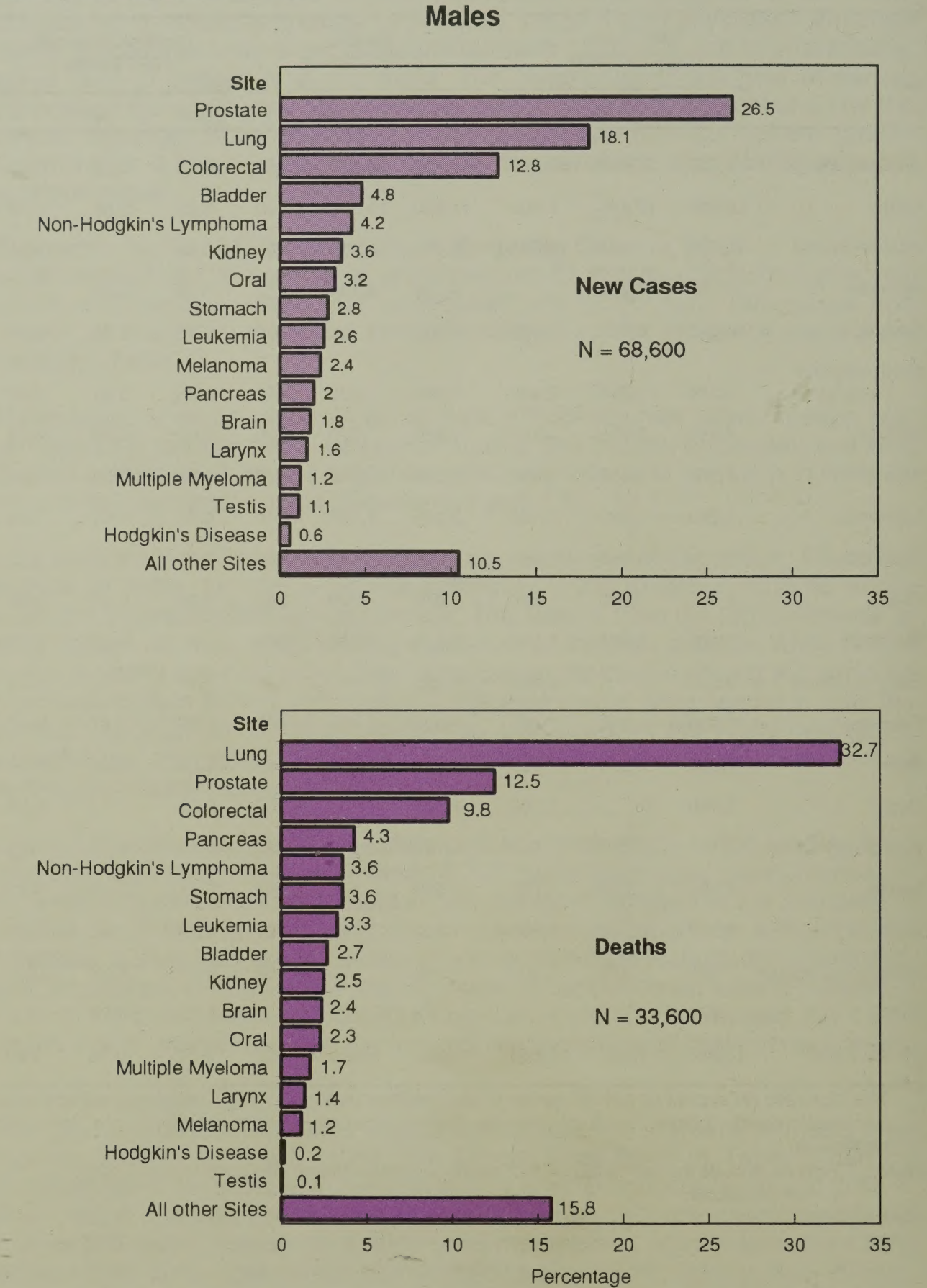
Site	New Cases 1996 Estimate			Deaths 1996 Estimate			Deaths/Cases ratio 1996 Estimate		
	Total	M	F	Total	M	F	Total	M	F
All Cancers	129,200	68,600	60,600	61,800	33,600	28,200	0.48	0.49	0.47
Lung	20,000	12,400	7,600	17,000	11,000	6,000	0.85	0.89	0.79
Female Breast	18,600	...	18,600	5,300	...	5,300	0.28	...	0.28
Prostate	18,200	18,200	...	4,200	4,200	...	0.23	0.23	...
Colorectal	16,300	8,800	7,500	6,200	3,300	2,900	0.38	0.38	0.39
Non-Hodgkin's Lymphoma	5,300	2,900	2,400	2,300	1,200	1,100	0.43	0.41	0.46
Bladder	4,450	3,300	1,150	1,320	920	400	0.30	0.28	0.35
Kidney	4,050	2,500	1,550	1,350	830	520	0.33	0.33	0.34
Leukemia	3,250	1,800	1,450	2,010	1,100	910	0.62	0.61	0.63
Melanoma	3,100	1,650	1,450	640	390	250	0.21	0.24	0.17
Oral	3,090	2,200	890	1,070	770	300	0.35	0.35	0.34
Stomach	3,000	1,950	1,050	2,000	1,200	800	0.67	0.62	0.76
Body of Uterus	3,000	...	3,000	620	...	620	0.21	...	0.21
Pancreas	2,900	1,350	1,550	2,950	1,450	1,500	1.02 ¹	1.07 ¹	0.97
Brain	2,230	1,250	980	1,430	790	640	0.64	0.63	0.65
Ovary	2,100	...	2,100	1,350	...	1,350	0.64	...	0.64
Multiple Myeloma	1,510	820	690	1,100	580	520	0.73	0.71	0.75
Larynx	1,360	1,100	260	560	470	90	0.41	0.43	0.35
Cervix	1,350	...	1,350	390	...	390	0.29	...	0.29
Hodgkin's Disease	820	420	400	140	75	65	0.17	0.18	0.16
Testis	770	770	...	25	25	...	0.03	0.03	...
All other sites	13,800	7,200	6,600	9,800	5,300	4,500	0.71	0.74	0.69

¹ The high ratio (in excess of 1.0) for cancer of the pancreas may result from incomplete registration of pancreatic cancer before death, or may be due to incorrect reporting of this cancer on death certificates.

Note: Figures exclude the estimated 62,500 cases of non-melanoma skin cancer (ICD-9 173).
 ... Not Applicable.

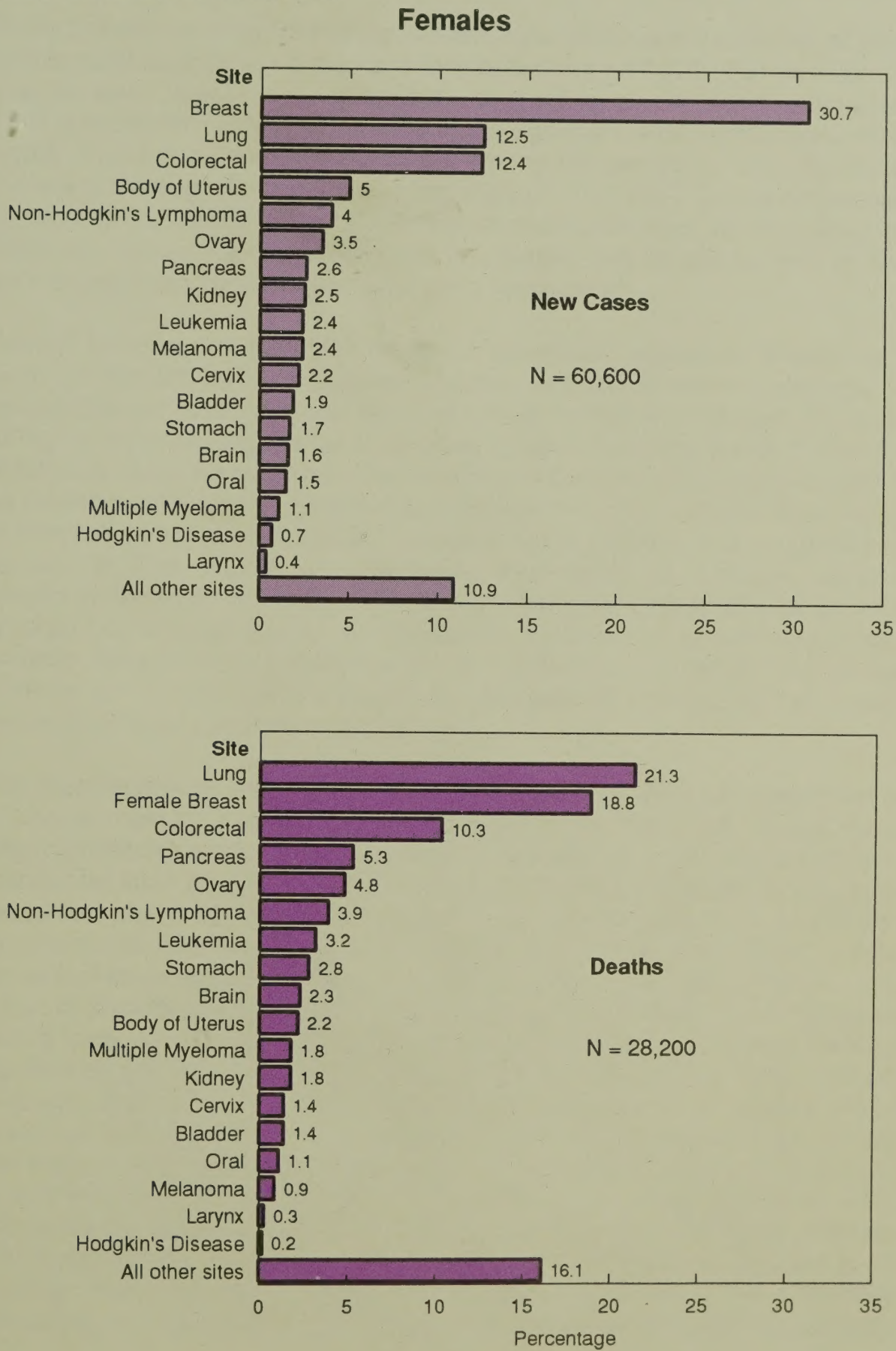
Source: Health Statistics Division, Statistics Canada.

Figure 1.1
Percent Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Males, Canada, 1996



Note: All figures exclude an estimated 62,500 cases of non-melanoma skin cancer (ICD-9 173) in both sexes combined.
Source: Health Statistics Division, Statistics Canada.

Figure 1.2
Percent Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Females, Canada, 1996



Note: All figures exclude an estimated 62,500 cases of non-melanoma skin cancer (ICD-9 173) in both sexes combined.

Source: Health Statistics Division, Statistics Canada.

GEOGRAPHIC PATTERNS OF CANCER OCCURRENCE

Table 2 presents estimates of population, new cases and deaths for all sites of cancer combined, by sex and by province or territory for 1996. For each province and for each specific type of cancer, the number of new cases estimated for 1996 is shown in Table 3. Estimates of the age-standardized incidence rates in Table 4 take into account differences among the provinces' age distributions, thereby facilitating inter-provincial comparisons. The 1991 Canadian population is used as the standard for calculating standardized rates, as described in the *Glossary*. Tables 5 and 6 present data in a similar way for the number of deaths and for age-standardized mortality rates, respectively.

Table 7 lists cancers for which there is a statistically significant difference of at least 20 percent between a provincial rate and the Canadian average, from among the ten most common types of cancer in men and women. The pattern of higher rates of lung cancer in Quebec males is consistent with higher levels of tobacco use in that province. The variability in the rates of prostate cancer may be related to differences in early detection activities. Low rates of breast cancer in Newfoundland may be related to reproductive patterns and socio-economic factors in that region. The relatively high rates of stomach cancer in Newfoundland are consistent with the greater use, historically, of salted and smoked foods. Low rates were reported for a number of cancer sites including bladder, lymphoma and leukemia for one or both sexes, which may be due to differences in diagnostic procedures available in the region, or reporting procedures used in cancer registration.

The interpretation of inter-provincial differences in the rates for a particular type of cancer must be made with caution. In particular, there are several reasons why it is difficult to attribute such differences to variation in known risk factors for that cancer site. First, due to the rarity of some forms of cancer, the number of cases occurring in a province during a one year period may be so small that the resultant rate estimates may be unreliable. For this reason, Table 7 refers to actual incidence data covering a five year period, 1987-1991, and incorporates a test of statistical significance to rule out chance variation. Conversely, rates from a large province such as Ontario are more stable, and are less likely to be significantly different partly because they contribute substantially to the Canadian average. Second, correlations between the incidence of disease and the prevalence of risk factors in geographical areas can be misleading. To prove that there is a causal association between a factor and a disease, it is necessary to perform more detailed studies of individuals. Third, for many cancers there is a long interval between exposure to a risk factor and the occurrence of disease, and information on the prevalence of risk factors in previous decades is often lacking. Fourth, there are differences between provinces in the availability of screening or early detection programs (e.g., for breast and prostate cancer).

Table 2
Estimated Population, New Cases and Deaths for All Cancers by Sex, Canada and Provinces/Territories, 1996

Province	Population (000s) 1996 Estimates ¹			New Cases 1996 Estimates ²			Deaths 1996 Estimates ²		
	Total	M	F	Total	M	F	Total	M	F
Canada³	29,914	14,807	15,107	129,200	68,600	60,600	61,800	33,600	28,200
Newfoundland	583	292	291	2,030	1,100	930	1,160	680	480
Prince Edward Island	137	68	69	680	340	340	320	180	140
Nova Scotia	947	468	479	5,000	2,700	2,300	2,400	1,350	1,050
New Brunswick	766	379	387	3,500	1,950	1,550	1,730	940	790
Quebec	7,385	3,638	3,747	31,200	16,700	14,500	16,900	9,300	7,600
Ontario	11,212	5,536	5,676	50,100	26,200	23,900	22,500	12,100	10,400
Manitoba	1,139	565	574	5,200	2,800	2,400	2,550	1,400	1,150
Saskatchewan	1,020	507	512	4,700	2,600	2,100	2,200	1,250	950
Alberta	2,784	1,396	1,388	9,600	5,000	4,600	4,600	2,500	2,100
British Columbia	3,845	1,909	1,936	17,200	9,200	8,000	7,500	4,000	3,500
Yukon ⁴	31	16	15	60	30	25	30	15	15
Northwest Territories ⁴	66	34	32	100	50	45	50	30	20

¹ 1996 population projections were provided by the Census and Demographics Branch, Statistics Canada.

² Figures exclude an estimated 62,500 cases of non-melanoma skin cancer (ICD-9 173).

³ Canada totals may not add due to rounding.

⁴ Figures for Yukon and Northwest Territories are based on the average of the most recent five years of available data: 1987-1991 for new cases, and 1989-1993 for deaths.

Source: Health Statistics Division, Statistics Canada.

Table 3
Estimated New Cases for Major Cancer Sites by Sex, Canada and Provinces, 1996

	New Cases										
	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	68,600	1,100	340	2,700	1,950	16,700	26,200	2,800	2,600	5,000	9,200
Prostate	18,200	210	110	600	640	3,400	6,500	1,050	800	1,400	3,500
Lung	12,400	180	55	550	350	3,800	4,600	370	410	790	1,400
Colorectal	8,800	190	35	360	240	2,200	3,500	360	310	630	960
Non-Hodgkin's											
Lymphoma	2,900	35	15	90	70	700	1,150	110	110	200	360
Bladder	3,300	100	10	160	120	1,150	840	160	180	280	310
Kidney	2,500	40	10	120	55	590	960	100	85	210	260
Oral	2,200	100	20	100	35	510	940	110	70	150	270
Stomach	1,950	50	10	80	45	480	750	90	65	150	210
Leukemia	1,800	15	5	65	35	480	820	55	80	110	140
Melanoma	1,650	10	10	85	55	210	780	40	65	150	230
Pancreas	1,350	15	10	65	35	340	520	50	45	150	160
Brain	1,250	10	5	35	25	320	540	45	40	110	100
Larynx	1,100	35	5	40	35	370	400	30	25	65	120
Multiple Myeloma	820	10	5	20	20	210	340	45	40	65	75
Females											
All Cancers	60,600	930	340	2,300	1,550	14,500	23,900	2,400	2,100	4,600	8,000
Breast	18,600	270	95	640	490	4,100	7,100	760	720	1,550	2,800
Lung	7,600	170	50	330	190	1,950	3,000	330	260	460	800
Colorectal	7,500	65	35	300	190	2,000	2,800	280	220	500	1,150
Body of Uterus	3,000	70	10	100	80	720	1,200	140	100	230	360
Non-Hodgkin's											
Lymphoma	2,400	25	15	80	65	560	950	110	100	160	320
Ovary	2,100	40	5	75	40	500	900	80	75	160	240
Kidney	1,550	30	10	75	55	390	590	65	55	120	160
Pancreas	1,550	5	10	65	30	390	600	70	50	120	190
Melanoma	1,450	25	10	70	60	200	590	50	50	150	260
Leukemia	1,450	25	--	50	25	390	630	50	70	85	120
Cervix	1,350	40	10	70	20	220	610	60	55	130	170
Bladder	1,150	20	10	55	55	350	350	55	55	100	90
Stomach	1,050	30	10	50	20	310	410	45	35	70	120
Brain	980	10	10	25	25	260	410	40	20	75	110
Oral	890	15	5	35	20	190	410	40	20	60	110
Multiple Myeloma	690	10	5	30	15	180	260	35	15	60	75

Note: Canadian totals may not add due to rounding. The Canada and provincial totals for all cancers exclude an estimated 62,500 cases of non-melanoma skin cancer (ICD-9 173). Due to changes and improvements in source data and in methodology, the 1996 estimates are not directly comparable to estimates published in years prior to 1995. Please refer to Appendix I: Methodology for further details. These estimates may vary from actual figures by about 5 to 15 percent. Please contact provincial cancer registries for the most current actual data.

-- Less than 5 cases.

Source: Health Statistics Division, Statistics Canada.

Table 4
Estimated Age-Standardized Incidence Rates for Major Cancer Sites by Sex,
Canada and Provinces, 1996

	Rate per 100,000										
	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	476	410	481	563	516	485	485	476	450	427	455
Prostate	124	80	153	124	165	102	124	170	135	124	177
Lung	89	68	81	117	95	110	83	60	71	68	68
Colorectal	61	69	51	77	62	63	65	61	52	54	47
Bladder	24	36	22	33	30	34	15	26	32	23	15
Non-Hodgkin's Lymphoma	20	12	18	18	19	20	21	18	20	15	18
Kidney	17	13	15	25	14	17	17	18	19	18	13
Oral	15	37	23	20	10	14	17	21	12	13	13
Stomach	14	21	15	17	12	14	14	15	10	13	10
Leukemia	13	7	11	14	9	14	15	9	14	9	7
Melanoma	11	3	13	18	14	6	14	8	12	12	11
Pancreas	9	7	16	13	9	10	9	9	7	13	8
Brain	9	3	7	8	7	9	10	8	7	9	5
Larynx	7	11	8	9	9	10	7	5	4	5	6
Multiple Myeloma	6	4	5	4	4	6	6	7	6	6	4
Females											
All Cancers	341	301	403	394	338	321	356	339	326	331	342
Breast	107	87	118	110	106	93	108	111	116	114	121
Lung	43	20	45	52	43	46	42	38	35	37	48
Colorectal	40	54	54	53	37	41	42	44	34	32	32
Body of Uterus	17	22	16	18	17	16	18	21	17	17	16
Non-Hodgkin's Lymphoma	13	8	18	13	14	12	14	16	15	11	14
Ovary	12	12	9	13	8	11	14	12	12	12	10
Melanoma	9	7	15	13	14	5	9	9	8	11	12
Kidney	9	7	9	12	12	9	9	10	8	9	7
Leukemia	8	8	6	8	5	9	9	6	10	6	5
Pancreas	8	5	9	10	5	8	8	9	6	8	7
Cervix	8	16	15	13	5	5	10	11	10	9	8
Bladder	6	7	10	8	12	7	5	8	8	7	3
Brain	6	4	6	5	6	6	6	7	3	5	5
Stomach	5	9	10	7	4	6	5	6	2	4	5
Oral	5	5	5	6	4	4	6	6	3	4	5
Multiple Myeloma	4	4	5	5	3	4	4	4	2	4	3

Note: Rates exclude non-melanoma skin cancer (ICD-9 173) and are adjusted to the age distribution of the 1991 Canadian population. (Prior to 1995, rates were adjusted to the World Standard Population.) For this reason, and due to changes and improvements in source data and methodology, the 1996 estimates are not comparable to estimates published in previous years. Please refer to Appendix I: Methodology for further details.

Source: Health Statistics Division, Statistics Canada.

Table 5
Estimated Deaths for Major Cancer Sites by Sex, Canada and Provinces, 1996

	Deaths										
	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Male											
All Cancers	33,600	680	180	1,350	940	9,300	12,100	1,400	1,250	2,500	4,000
Lung	11,000	220	50	460	340	3,600	3,600	410	360	700	1,250
Prostate	4,200	80	30	160	120	930	1,550	220	210	350	570
Colorectal	3,300	65	10	100	55	1,000	1,200	140	130	250	330
Pancreas	1,450	20	10	60	35	360	520	55	60	140	180
Stomach	1,200	50	5	45	35	350	380	60	50	75	140
Non-Hodgkin's											
Lymphoma	1,200	20	5	40	40	300	470	50	50	80	140
Leukemia	1,100	15	--	40	25	320	430	45	45	90	100
Bladder	920	30	5	30	25	220	340	45	30	70	130
Kidney	830	15	5	40	20	230	280	40	35	70	100
Brain	790	15	5	35	20	220	270	25	30	70	90
Oral	770	10	5	35	20	280	240	25	15	45	90
Multiple Myeloma	580	10	5	20	15	150	200	25	30	55	65
Larynx	470	5	--	15	10	180	160	15	20	20	35
Melanoma	390	--	5	20	15	65	170	15	10	35	60
Females											
All Cancers	28,200	480	140	1,050	790	7,600	10,400	1,150	950	2,100	3,500
Lung	6,000	65	35	230	170	1,600	2,200	240	180	410	940
Breast	5,300	85	20	190	140	1,450	2,000	180	190	440	600
Colorectal	2,900	40	15	85	75	1,000	1,000	130	95	170	260
Pancreas	1,500	15	10	60	35	370	560	65	70	110	210
Ovary	1,350	25	5	40	40	320	530	50	45	110	190
Non-Hodgkin's											
Lymphoma	1,100	10	5	40	40	280	430	55	55	65	130
Leukemia	910	15	5	30	20	270	340	35	35	55	100
Stomach	800	40	10	35	20	250	250	40	25	60	75
Brain	640	5	5	20	20	190	220	25	15	50	95
Body of Uterus	620	10	5	20	20	200	210	30	15	55	65
Multiple Myeloma	520	15	5	25	10	150	180	25	15	40	60
Kidney	520	15	5	20	20	130	170	25	15	55	65
Bladder	400	10	--	10	15	100	140	25	15	30	55
Cervix	390	5	5	20	5	75	160	20	15	35	50
Oral	300	5	--	10	5	70	120	15	10	25	45
Melanoma	250	--	--	--	5	60	120	5	10	20	35

Note: Canadian totals may not add due to rounding. The Canada and provincial totals for all cancers exclude non-melanoma skin cancer (ICD-9 173). Due to changes and improvements in source data and in methodology, the 1996 estimates are not directly comparable to estimates published in previous years. Please refer to Appendix I: Methodology for further details. These estimates may vary by about 5 to 15 percent.

-- Less than 5 cases.

Source: Health Statistics Division, Statistics Canada.

Table 6
Estimated Age-Standardized Mortality Rates for Major Cancer Sites by Sex,
Canada and Provinces, 1996

	Rate per 100,000										
	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	241	267	249	284	252	281	231	240	217	217	205
Lung	78	83	72	96	92	105	68	70	63	62	64
Prostate	32	35	38	35	33	31	32	36	34	33	30
Colorectal	24	24	15	21	15	31	23	24	22	22	17
Pancreas	10	8	15	13	9	10	10	9	9	12	9
Stomach	9	20	8	9	9	11	7	11	8	6	7
Leukemia	8	5	6	9	6	10	8	7	7	8	5
Non-Hodgkin's Lymphoma	8	6	4	9	10	9	9	8	8	6	7
Bladder	7	13	4	7	6	7	7	8	5	6	6
Kidney	6	6	9	8	5	7	5	7	6	6	5
Brain	5	5	5	7	5	6	5	5	5	6	5
Oral	5	4	8	7	5	8	4	4	3	4	5
Multiple Myeloma	4	5	4	4	4	5	4	4	5	5	3
Larynx	3	2	3	3	3	5	3	2	3	2	2
Melanoma	3	1	3	4	3	2	3	2	2	3	3
Females											
All Cancers	153	154	158	173	162	162	151	151	135	149	146
Lung	34	22	36	40	37	36	32	33	27	30	40
Breast	29	28	26	33	29	32	30	24	27	31	25
Colorectal	15	13	14	13	14	21	14	16	12	12	10
Pancreas	8	6	8	9	7	8	8	8	9	8	8
Ovary	8	8	6	6	8	7	8	7	6	8	8
Non-Hodgkin's Lymphoma	6	4	4	6	8	6	6	7	8	4	5
Leukemia	5	5	4	5	3	6	5	5	5	4	4
Stomach	4	12	7	4	4	5	3	5	3	4	3
Brain	4	1	1	4	4	4	3	4	2	4	4
Body of Uterus	3	4	4	3	4	4	3	3	2	4	2
Kidney	3	4	3	3	4	3	2	3	2	4	3
Multiple Myeloma	3	3	2	3	2	3	3	3	2	2	2
Cervix	2	2	2	4	1	2	2	3	3	2	2
Bladder	2	2	1	1	1	2	2	3	2	2	2
Oral	2	1	1	1	1	2	2	2	1	2	2
Melanoma	1	--	--	1	--	1	2	1	1	1	1

Note: Rates exclude non-melanoma skin cancer (ICD-9 173) and are adjusted to the age distribution of the 1991 Canadian Population. Prior to 1995, rates were adjusted to the World Standard Population.) For this reason, and due to changes and improvements in source data and methodology, the 1996 estimates are not directly comparable to estimates published in previous years. Please refer to Appendix I: Methodology for further details.

-- Estimated age-standardized mortality rate is less than 0.5 per 100,000.

Source: Health Statistics Division, Statistics Canada.

Table 7
Province-to-Canada Ratios of Age-Standardized Incidence Rates by Sex and Selected Cancer Sites, 1987-1991

Site	Rate Ratio (≤ 0.80)			Rate Ratio (≥ 1.20)		
	Province	Male	Female	Province	Male	Female
Lung	Sask.	0.80	...	Que.	1.27	...
	Alta.	0.79	...	...	...	...
	Nfld.	...	0.49	...	...	...
Prostate	Nfld.	0.66	...	B.C.	1.30	...
Breast	Nfld.	...	0.80	...	...	...
Melanoma	Que.	0.46	0.48	Ont.	1.30	...
	Nfld.	0.34	0.65	B.C.	1.28	1.43
				N.S.	...	1.31
Stomach	...	...	...	Nfld.	1.81	1.65
Bladder	B.C.	0.63	0.63	Que.	1.22	...
Kidney	B.C.	...	0.78	...	...	...
Non-Hodgkin's Lymphoma	Nfld.	0.60	0.59	...	...	...
Leukemia	N.B.	0.76	...	...	...	...
	Nfld.	0.59	0.69	...	...	...
	B.C.	...	0.80	...	...	...
	Alta.	...	0.80	...	...	...
Oral	Que.	...	0.77	Nfld.	1.61	...
	N.B.	...	0.69	Man.	1.21	...

Notes: Rate ratios for the ten most common forms of cancer are shown only for those provinces where rates are significantly different from the Canadian rate at the $p = 0.01$ level, and where the rate ratio is ≤ 0.80 or ≥ 1.20 .
 ... Not Applicable.

Source: Health Statistics Division, Statistics Canada.

TRENDS IN INCIDENCE AND MORTALITY

Recent trends in incidence and mortality for major types of cancer are assessed by comparing annual age-standardized rates. Figure 2 presents the number of new cases and deaths together with the corresponding age-standardized rates for Canadian men and women from 1969-1996. Detailed depictions of the trends in annual rates since 1969 are presented in Figures 3 and 4 with the data points provided in Tables 8 and 9. The average annual percent changes in site-specific incidence and mortality rates since 1984 are listed in Table 10 and plotted in Figure 5.

The process of age-standardization permits comparisons between calendar years, since it accounts for changes that have occurred over time in the age distribution of the population. **Rates in this publication have been standardized to the 1991 Canadian population and can not be compared directly to those in editions prior to 1995.** Rates standardized to the 1991 Canadian population are generally about 30 to 50 percent higher than those standardized to the World Standard Population used prior to 1995, because the 1991 Canadian population is older. The 1991 Canadian population is preferred because rates standardized to this population more closely reflect the actual burden of cancer per 100,000 Canadian men or women.

All Sites

Trends of incidence and mortality rates for all cancer sites combined have remained relatively stable since 1984 among women, as the average annual percent changes for these rates are close to zero (Table 10). However, among men, incidence rates for all cancer sites combined are rising slightly due to the sharp increase in incidence of prostate cancer. By contrast, mortality rates for men appear to have peaked and are now gradually declining due to the decreasing rates for lung, colorectal and other cancers among men. The rapid increases in incidence rates throughout the 1970s displayed in Figure 2.1 largely reflect improved registration of new cases during this period in several provincial registries.^{2,26} Registration levels since 1981 have generally stabilized due to increasing consistency of cancer reporting procedures across Canada.

Despite the relative stability in the age-standardized rates, the numbers of new cases and deaths continue to rise steadily as the Canadian population ages (Figures 2.1 and 2.2). The number of new cases and deaths, as opposed to rates, are important indicators of the extent of cancer burden on the Canadian population and the health care system. These numbers can be used to plan patient services and health care facilities. In 1996, the estimated 129,200 new cases of cancer diagnosed in Canadians represents an increase of about 3,000 cases each year from the 49,188 cases reported in 1969. Similarly the number of cancer deaths has more than doubled to an estimated 61,800 in 1996, increasing at a rate of 1,200 per year from the 29,523 deaths recorded in 1969.

Figure 6 plots an index of age-standardized mortality rates since 1971 for all sites combined and for all sites excluding lung cancer. Among men, lung cancer was responsible for the increase in mortality rates for all cancer sites combined

during much of this period. However, cancer mortality rates among men have declined slightly from the peak in 1988, whether or not lung cancer rates are included. Among women, overall cancer mortality rates have been stable, while mortality for all sites excluding lung cancer has declined steadily.

Trends by Selected Sites

Time trends of incidence and mortality rates since 1969 for selected cancer sites are shown for men in Figures 3.1 and 3.2 and for women in Figures 4.1 and 4.2. Tables 8 and 9 present the data points plotted in Figures 3 and 4. The trends over the past decade for the cancer sites examined in this publication are summarized in Table 10 and Figure 5. This year, trends in the incidence and mortality for the majority of cancer sites have stabilized or declined, although there are some notable exceptions as described below.

Among men, incidence and mortality rates for *lung cancer* levelled off in the mid-1980s and since the late 1980s have consistently declined, likely reflecting the fall in tobacco consumption among men that began in the mid-1960s. In contrast, incidence and mortality rates of lung cancer in women continue to increase steadily and are now almost four and one-half times as high as the 1970 rate. Estimated rates for lung cancer among women in 1996 are about half as high as those for men.

Breast cancer incidence among women has also risen steadily over the past decade; this increase may be due, in part, to the rising number of mammographic examinations since the mid-1980s, but may also be affected by reproductive histories, as much of the increase is occurring in women above the age targeted for screening programs. But while incidence is rising, *mortality* rates for breast cancer have declined very slightly over the past decade, and particularly since 1990, to the extent that the breast cancer mortality rate for 1993 is the lowest ever recorded during the period 1969-1993.

Age-standardized incidence rates for *prostate cancer* have increased sharply in the past several years, while mortality rates have risen at a slower rate. (See the special section on prostate cancer.) Finally, incidence and mortality rates for *colorectal cancer* continue to decline, particularly among women. The reason for these declines is not completely understood. Research conducted in the United States^{7,19} suggests that more widespread use of methods for early detection may allow for more effective treatment for earlier staged disease, particularly among the elderly. Also, some evidence suggests that lifestyle changes such as diet may have contributed to the declines. The declining trend in rates of *bladder cancer* of about -2% per year for incidence and just over -1% per year for mortality is of interest. Part of the decline in incidence may be the result of changing reporting procedures for at least one registry in Canada; however, the fact that mortality is also declining, but at a slower pace, may indicate either decreasing incidence or improved survival.

Of the more commonly occurring cancers, just four among men and two among women have increased at an average rate greater than 2 percent annually since 1984 (Figure 5). Among men, these are prostate (4.1% per year), melanoma (2.7%), kidney (2.5%) and non-Hodgkin's lymphoma (2.2%), and among women, lung (3.5%) and kidney (2.3%). Patterns of exposure to sunlight may affect melanoma rates, while the increase in non-Hodgkin's lymphoma is at least partly

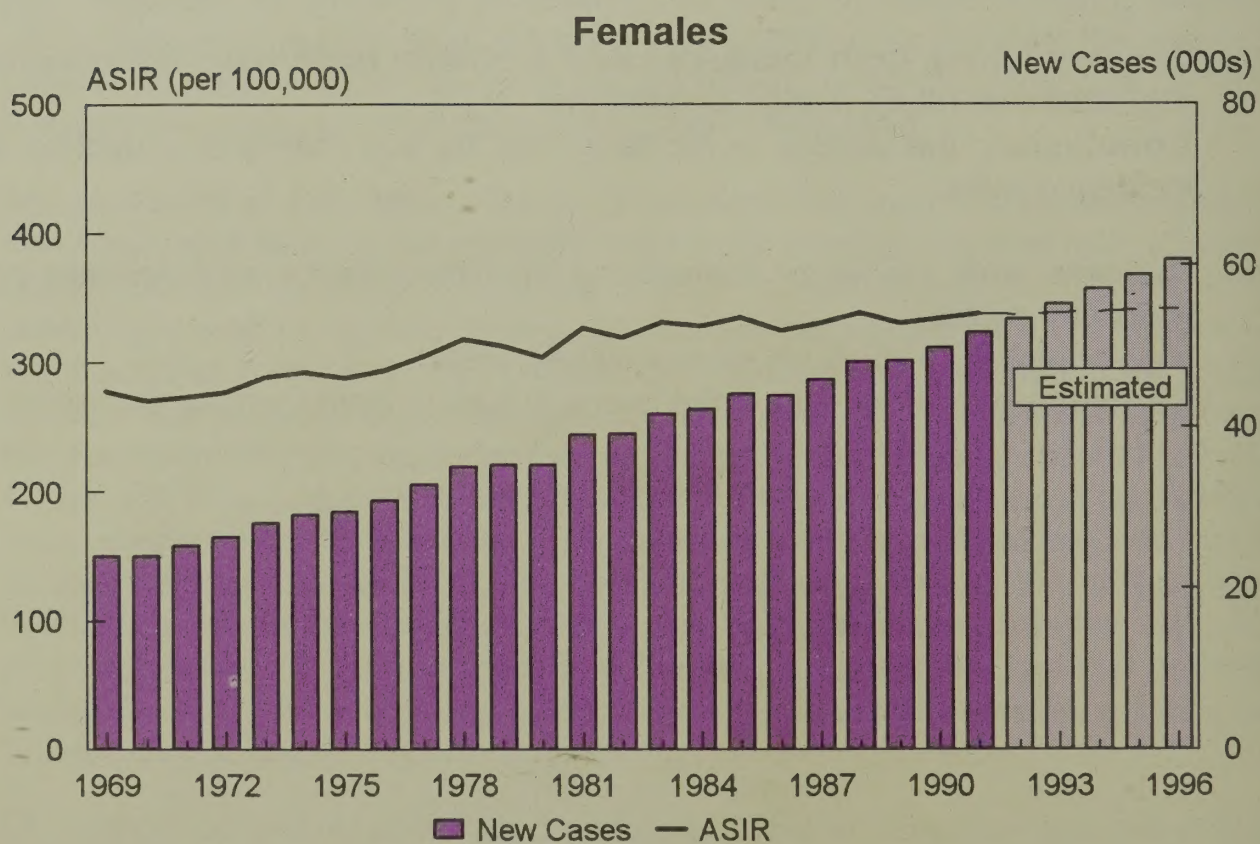
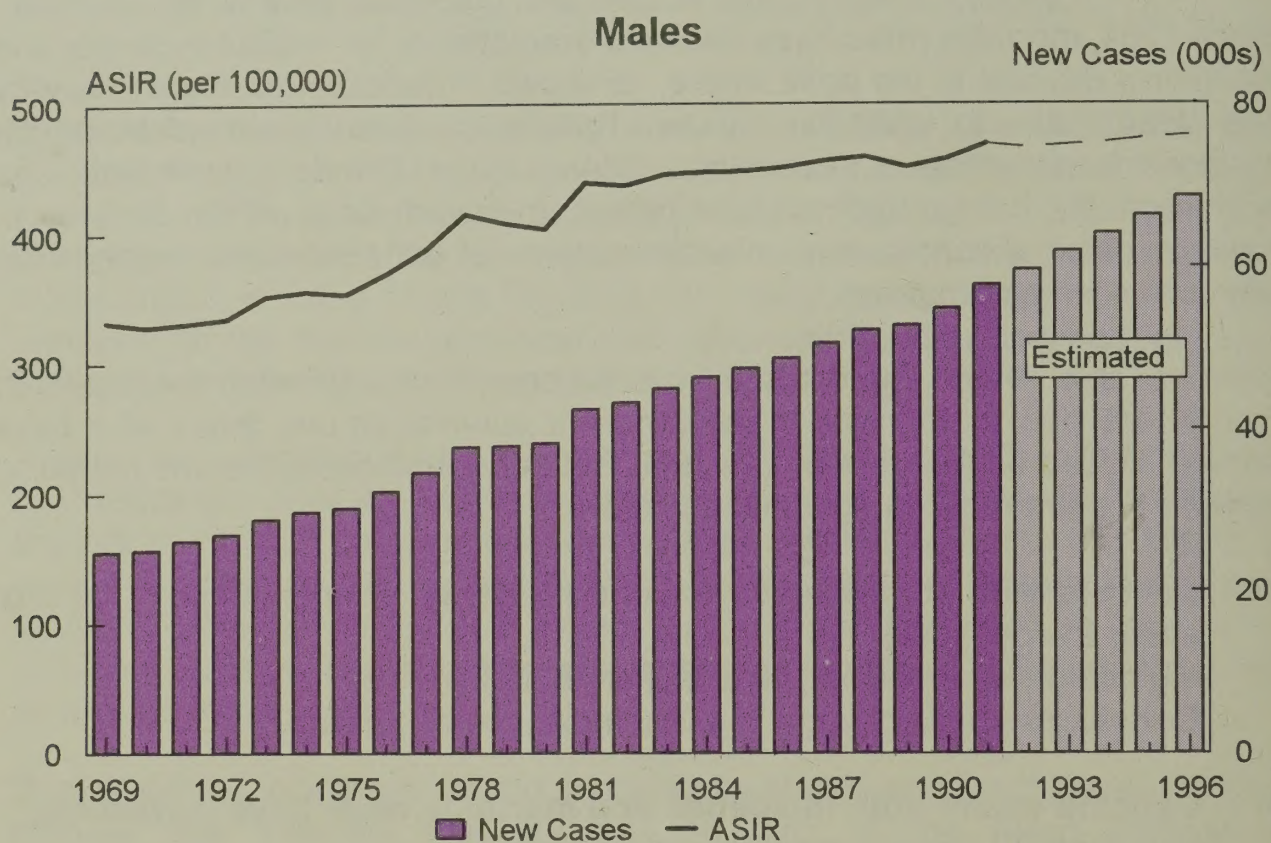
related to the increased levels of HIV infection. Risk factors for cancer of the kidney include cigarette smoking; the influence of other factors is difficult to determine.

Since 1984, mortality rates have declined dramatically for testicular cancer and Hodgkin's disease to the point where, as shown in Table 1, there are now very few deaths due to testicular cancer. This results from improved treatment methods despite stable or increasing incidence rates. The declines in incidence and mortality for stomach cancer reflect improved diets, while declines in invasive cervical cancer may reflect the impact of early detection through Pap smear screening programs.

Data in Table 10 and Figures 3 to 5 can be used to infer whether the observed trends are due to changes in incidence or survival among those who have cancer. Based on their trends over the past decade in incidence and mortality, specific sites may be categorized as follows:

- **Cancers with stable incidence and mortality rates** (changing less than about 2% per year):
e.g., lung (M); oral (M,F); and leukemia (M,F).
Conclusion: little change in either incidence or survival.
- **Cancers where both incidence and mortality rates have increased:**
e.g., lung (F); melanoma (M); and prostate.
Conclusion: the increase in mortality is due in part to the increase in incidence.
- **Cancers where both incidence and mortality rates have decreased:**
e.g., stomach (M,F); cervix; and bladder (M,F).
Conclusion: the decline in mortality may be due mainly to a decline in incidence rates.
- **Cancers with stable or increasing incidence rates and decreasing mortality rates:**
e.g., breast (F); Hodgkin's disease (M,F); testis.
Conclusion: the mortality trend is due in part to increased survival rates.

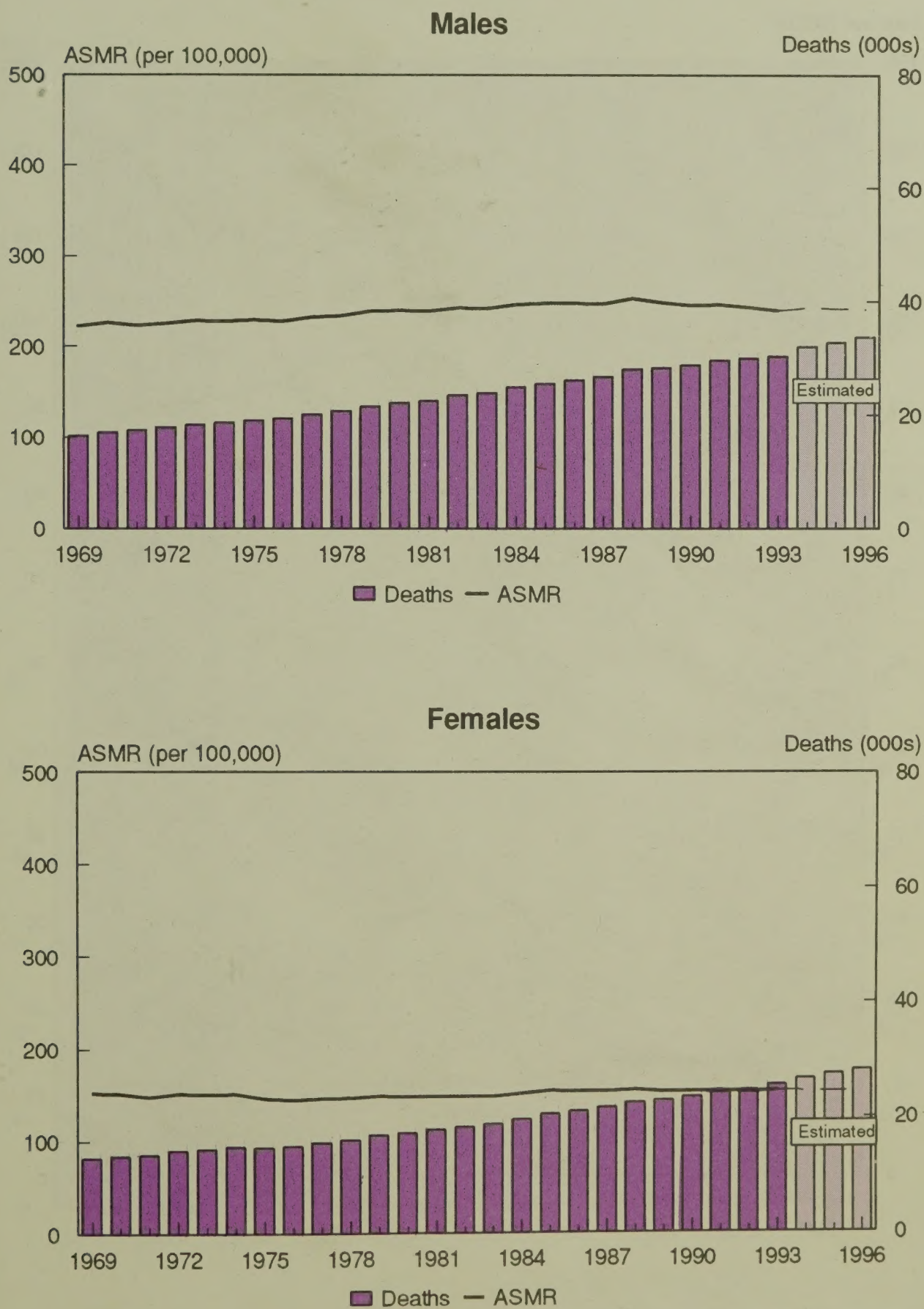
Figure 2.1
New Cases and Age-Standardized Incidence Rates (ASIR) for All Cancers,
Canada, 1969-1996



Note: All cancer excludes non-melanoma skin cancer (ICD-9 173). Rates are standardized to the 1991 Canadian population.

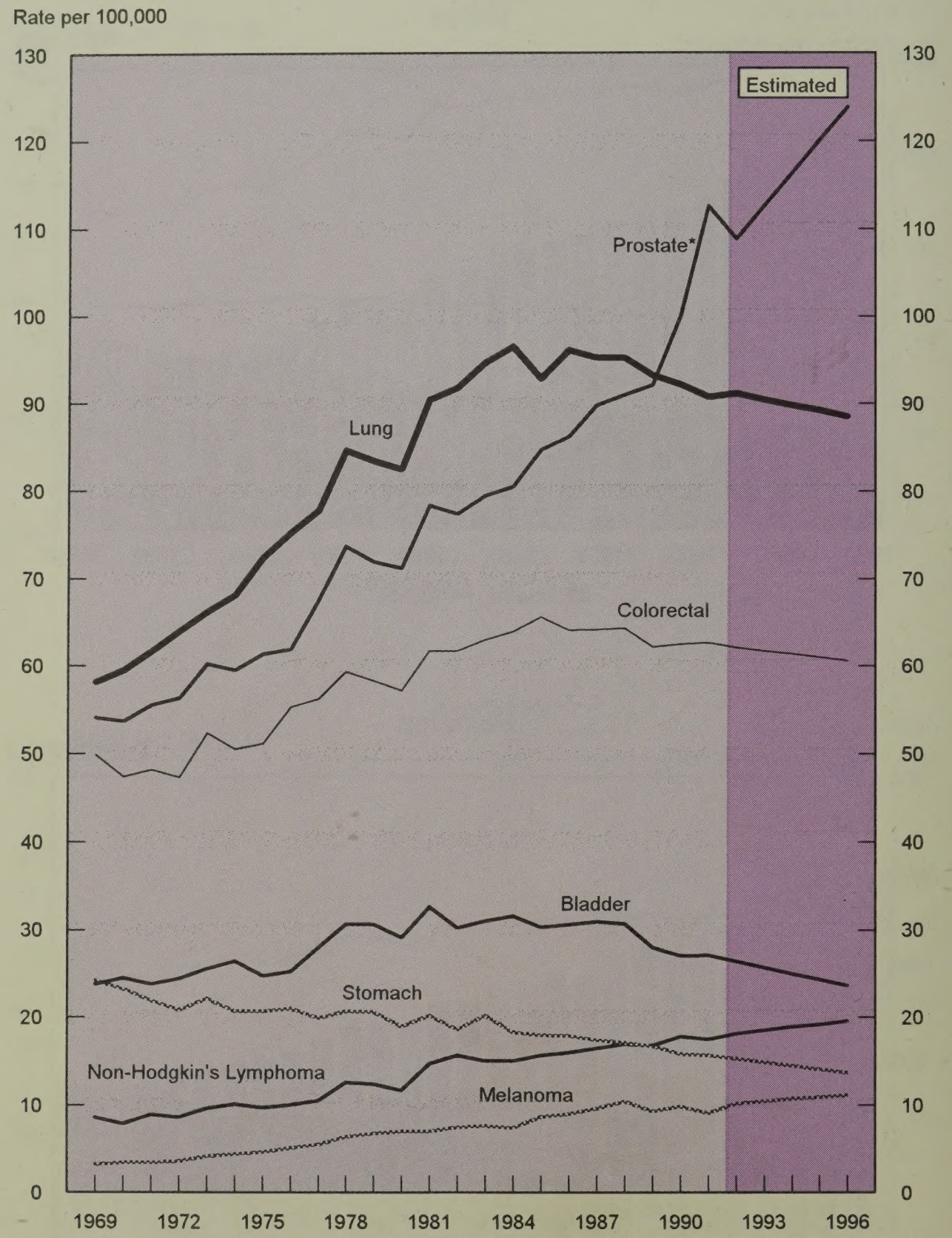
Source: Health Statistics Division, Statistics Canada.

Figure 2.2
Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1969-1996



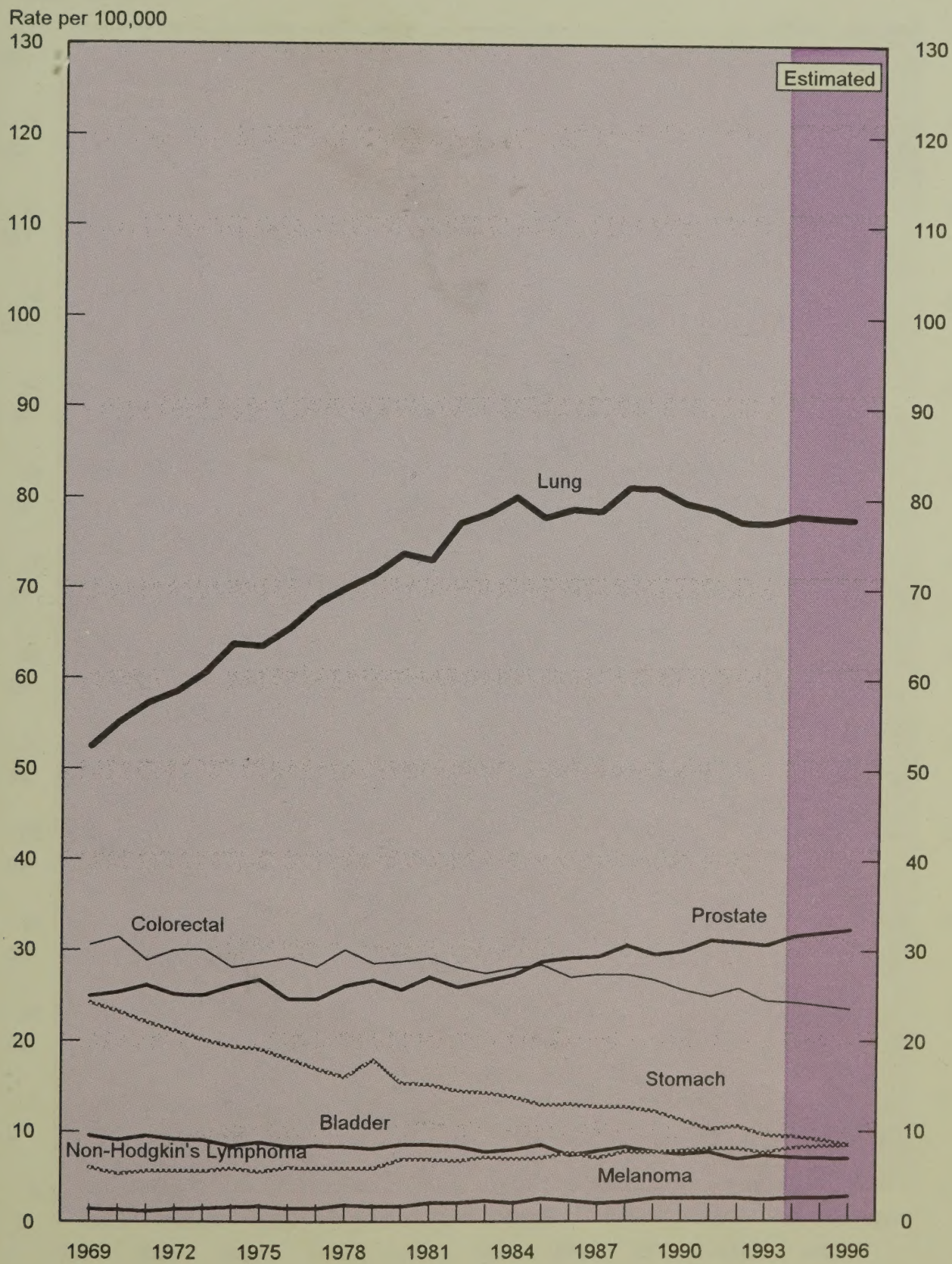
Note: All cancer excludes non-melanoma skin cancer (ICD-9 173). Rates are standardized to the 1991 Canadian population.
Source: Health Statistics Division, Statistics Canada.

Figure 3.1
Age-Standardized Incidence Rates for Selected Cancer Sites, Males, Canada, 1969-1996



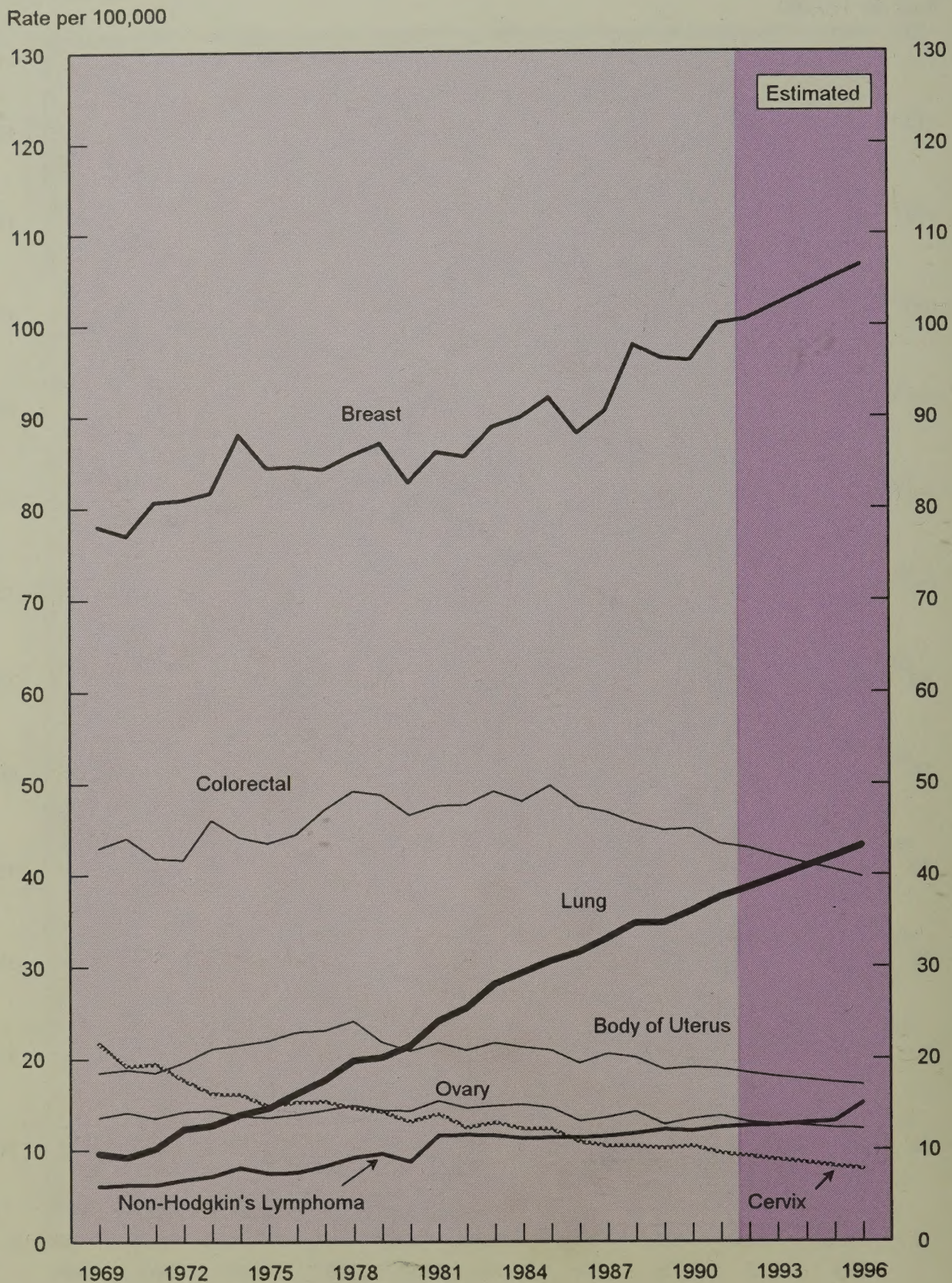
* Current rates for prostate cancer are likely underestimated because they do not fully account for the impact of PSA testing in the 1990s. (See special section on prostate cancer.)
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.1 for data points.
Source: Health Statistics Division, Statistics Canada.

Figure 3.2
Age-Standardized Mortality Rates for Selected Cancer Sites, Males, Canada, 1969-1996



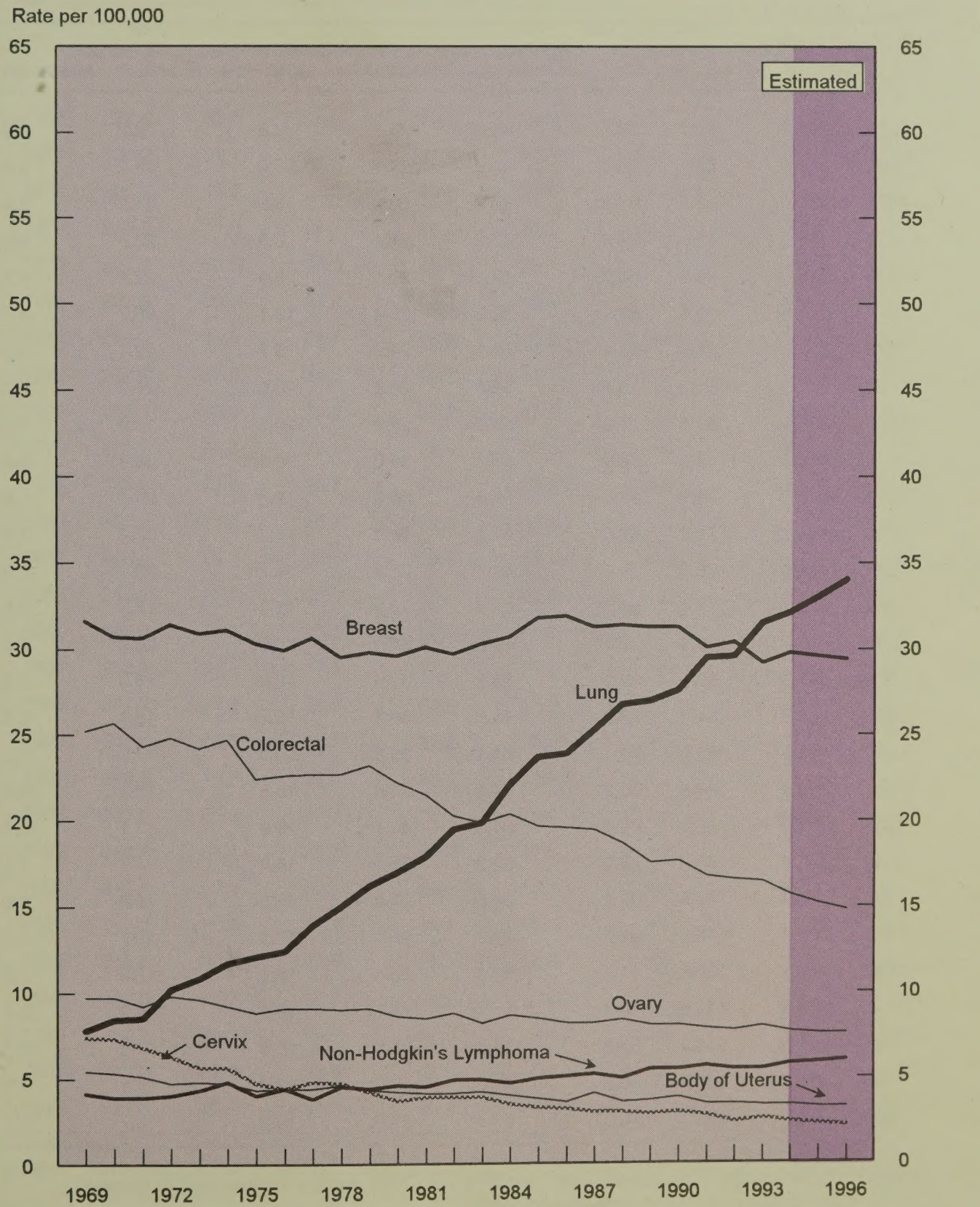
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.2 for data points.
Source: Health Statistics Division, Statistics Canada.

Figure 4.1
Age-Standardized Incidence Rates for Selected Cancer Sites, Females, Canada, 1969-1996



Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 9.1 for data points.
Source: Health Statistics Division, Statistics Canada.

Figure 4.2
Age-Standardized Mortality Rates for Selected Cancer Sites, Females, Canada, 1969-1996



Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 9.2 for data points.

Source: Health Statistics Division, Statistics Canada.

Table 8.1
Age-Standardized Incidence Rates for Selected Cancer Sites, Males, Canada,
1969-1996

Year	Rate per 100,000							
	All Cancers	Prostate	Lung	Colorectal	Bladder	Non-Hodgkin's Lymphoma	Stomach	Melanoma
1969	332.4	54.1	58.1	49.9	23.8	8.6	24.2	3.2
1970	328.8	53.7	59.5	47.4	24.5	7.9	23.2	3.4
1971	331.7	55.5	61.6	48.2	23.8	8.9	21.9	3.4
1972	335.3	56.3	63.9	47.3	24.4	8.6	20.8	3.6
1973	352.7	60.2	66.2	52.3	25.5	9.6	22.1	4.1
1974	356.3	59.5	68.1	50.5	26.4	10.1	20.7	4.4
1975	354.6	61.3	72.4	51.1	24.7	9.7	20.7	4.6
1976	369.8	61.9	75.2	55.3	25.2	10.0	21.0	5.1
1977	388.1	67.5	77.8	56.2	28.0	10.5	19.9	5.5
1978	415.5	73.6	84.6	59.3	30.6	12.6	20.7	6.4
1979	408.1	71.9	83.4	58.3	30.6	12.4	20.6	6.8
1980	404.2	71.2	82.5	57.2	29.1	11.7	18.9	7.0
1981	439.9	78.3	90.4	61.7	32.6	14.7	20.2	7.0
1982	437.7	77.4	91.8	61.7	30.2	15.7	18.6	7.5
1983	446.2	79.4	94.6	63.0	31.0	15.0	20.2	7.6
1984	447.8	80.5	96.5	63.9	31.6	15.0	18.3	7.4
1985	448.6	84.7	92.8	65.6	30.3	15.7	18.0	8.7
1986	451.6	86.2	96.1	64.1	30.6	16.0	17.9	9.0
1987	456.4	89.8	95.2	64.2	30.9	16.5	17.4	9.6
1988	459.6	91.0	95.2	64.3	30.7	16.9	17.1	10.4
1989	451.8	92.1	93.2	62.2	28.0	16.8	16.7	9.3
1990	457.7	100.0	92.2	62.5	27.0	17.8	15.8	9.9
1991	469.4	112.5	90.7	62.7	27.1	17.5	15.7	9.1
* 1992	466.1	108.8	91.1	62.1	26.4	18.1	15.3	10.2
* 1993	468.5	112.6	90.4	61.7	25.7	18.5	14.9	10.4
* 1994	470.9	116.3	89.8	61.4	25.0	18.9	14.5	10.7
* 1995	473.3	120.1	89.2	61.0	24.3	19.2	14.1	10.9
* 1996	475.7	123.8	88.5	60.6	23.6	19.6	13.7	11.1

* *Estimated Rates*

Note: Rates exclude non-melanoma skin cancer (ICD-9 173) and are standardized to the age distribution of the 1991 Canadian population.

Source: Health Statistics Division, Statistics Canada.

Table 8.2
Age-Standardized Mortality Rates for Selected Cancer Sites, Males, Canada, 1969-1996

Year	Rate per 100,000							
	All Cancers	Lung	Prostate	Colorectal	Stomach	Non-Hodgkin's Lymphoma	Bladder	Melanoma
1969	222.4	52.4	24.9	30.5	24.2	6.0	9.5	1.4
1970	226.2	55.1	25.3	31.4	23.2	5.3	9.0	1.3
1971	223.2	57.2	26.1	28.8	22.0	5.6	9.5	1.2
1972	225.5	58.5	25.1	30.0	21.1	5.6	9.1	1.4
1973	227.9	60.6	25.0	30.1	20.1	5.6	9.0	1.5
1974	227.3	63.8	26.0	28.1	19.4	5.9	8.4	1.6
1975	228.0	63.5	26.7	28.6	19.1	5.5	8.8	1.7
1976	227.7	65.6	24.6	29.1	18.1	6.0	8.3	1.5
1977	231.0	68.3	24.6	28.2	17.0	5.9	8.4	1.5
1978	233.7	70.0	26.1	30.1	16.0	5.9	8.3	1.9
1979	238.3	71.6	26.7	28.6	18.0	5.9	8.1	1.7
1980	239.6	73.8	25.7	28.8	15.4	6.9	8.6	1.7
1981	238.4	73.1	27.1	29.2	15.3	6.9	8.6	2.1
1982	242.2	77.2	26.0	28.2	14.6	6.8	8.4	2.1
1983	241.8	78.3	26.7	27.6	14.3	7.2	7.8	2.3
1984	246.4	80.1	27.4	28.2	13.9	7.0	8.0	2.1
1985	247.9	77.9	28.9	28.5	13.0	7.1	8.6	2.6
1986	247.6	78.8	29.3	27.2	13.1	7.7	7.4	2.3
1987	246.9	78.6	29.4	27.5	12.8	7.1	7.9	2.0
1988	253.4	81.2	30.7	27.5	12.8	7.8	8.3	2.2
1989	248.5	81.1	29.7	26.9	12.3	7.7	7.8	2.6
1990	245.7	79.5	30.1	25.8	11.3	7.9	7.5	2.6
1991	246.5	78.8	31.2	25.1	10.3	8.1	7.7	2.6
1992	243.1	77.4	31.0	25.9	10.6	8.1	6.9	2.6
1993	239.8	77.3	30.7	24.5	9.6	7.6	7.3	2.4
* 1994	242.7	78.1	31.7	24.4	9.4	8.2	7.1	2.6
* 1995	242.0	77.9	32.0	24.0	9.0	8.3	7.0	2.6
* 1996	241.3	77.7	32.3	23.6	8.5	8.4	6.9	2.7

* *Estimated Rates*
Note: Rates exclude non-melanoma skin cancer (ICD-9 173) and are standardized to the age distribution of the 1991 Canadian population.
Source: Health Statistics Division, Statistics Canada.

Table 9.1
Age-Standardized Incidence Rates for Selected Cancer Sites, Females,
Canada, 1969-1996

Year	Rate per 100,000									
	All Cancers	Breast	Lung	Colorectal	Body of Uterus	Non-Hodgkin's Lymphoma	Ovary	Melanoma	Cervix	Stomach
1969	277.5	78.0	9.6	42.9	18.5	6.1	13.6	4.7	21.6	11.2
1970	270.1	77.0	9.2	44.0	18.8	6.2	14.1	4.1	19.2	11.0
1971	273.5	80.7	10.2	41.8	18.5	6.2	13.5	4.0	19.4	11.1
1972	277.7	80.9	12.3	41.7	19.6	6.8	14.2	4.1	17.7	9.9
1973	289.0	81.7	12.7	46.0	21.1	7.2	14.4	5.1	16.2	10.4
1974	293.0	88.0	13.9	44.1	21.5	8.1	13.7	5.0	16.1	9.7
1975	287.9	84.4	14.6	43.5	21.9	7.5	13.6	5.1	14.8	10.2
1976	293.8	84.5	16.2	44.4	22.9	7.6	13.9	5.6	15.2	9.2
1977	304.5	84.2	17.7	47.1	23.0	8.3	14.4	6.1	15.3	9.2
1978	317.8	85.8	19.8	49.2	24.1	9.2	14.9	7.6	14.6	9.4
1979	312.6	87.1	20.1	48.8	21.8	9.6	14.4	7.1	14.2	9.1
1980	303.8	82.8	21.4	46.6	20.8	8.8	14.3	7.6	13.1	8.5
1981	326.7	86.1	24.1	47.6	21.7	11.6	15.4	7.9	14.0	9.7
1982	319.4	85.6	25.5	47.7	20.9	11.7	14.6	7.5	12.5	8.7
1983	331.3	88.9	28.1	49.2	21.7	11.6	14.8	8.1	13.0	8.6
1984	327.8	89.9	29.4	48.1	21.2	11.3	15.0	7.6	12.3	8.0
1985	334.6	92.0	30.6	49.8	20.9	11.4	14.6	9.4	12.3	8.0
1986	324.5	88.2	31.6	47.5	19.5	11.4	13.2	8.4	10.9	8.2
1987	330.2	90.6	33.1	46.9	20.5	11.5	13.6	9.3	10.4	8.0
1988	338.2	97.8	34.7	45.7	20.1	11.8	14.2	9.2	10.4	7.3
1989	330.3	96.4	34.7	44.9	18.8	12.2	12.8	8.5	10.2	7.1
1990	333.8	96.1	36.1	45.1	19.0	12.1	13.4	8.5	10.4	6.9
1991	337.4	100.2	37.6	43.4	18.9	12.5	13.7	8.8	9.6	6.5
* 1992	336.8	100.6	38.6	42.9	18.4	12.6	13.0	8.9	9.3	6.4
* 1993	337.9	102.1	39.7	42.1	18.0	12.7	12.8	8.9	8.9	6.1
* 1994	338.9	103.6	40.9	41.3	17.7	12.9	12.6	9.0	8.6	5.9
* 1995	340.0	105.1	42.0	40.6	17.4	13.1	12.4	9.0	8.2	5.6
* 1996	341.1	106.6	43.2	39.8	17.1	13.3	12.3	9.1	7.9	5.4

* *Estimated Rates*

Note: Rates exclude non-melanoma skin cancer (ICD-9 173) and are standardized to the age distribution of the 1991 Canadian population.

Source: Health Statistics Division, Statistics Canada.

Table 9.2
Age-Standardized Mortality Rates for Selected Cancer Sites, Females,
Canada 1969-1996

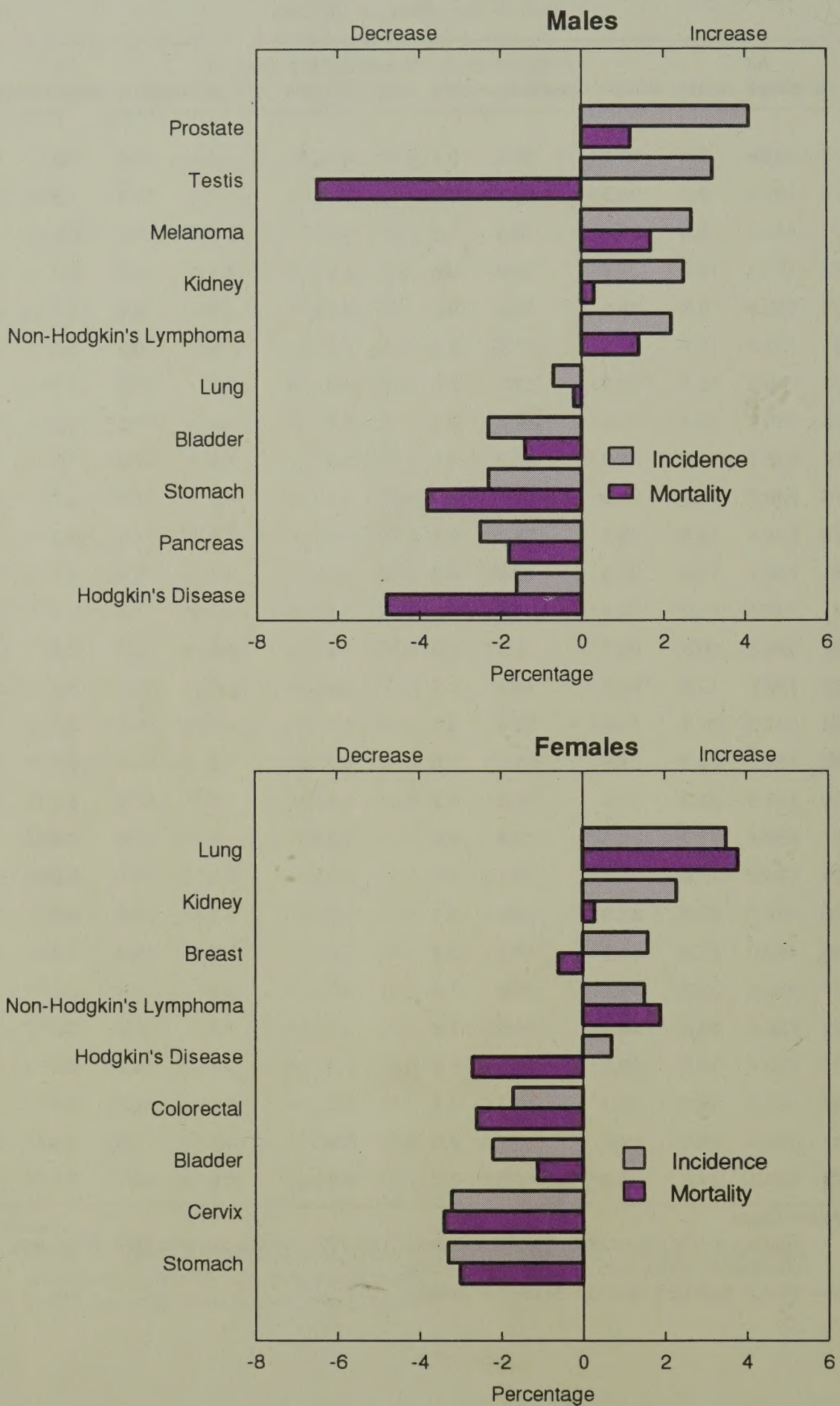
Year	Rate per 100,000									
	All Cancers	Lung	Breast	Colorectal	Ovary	Non-Hodgkin's Lymphoma	Body of Uterus	Stomach	Cervix	Melanoma
1969	152.5	7.8	31.6	25.2	9.7	4.1	5.4	10.6	7.4	1.3
1970	151.1	8.4	30.7	25.7	9.7	3.9	5.3	11.3	7.3	1.1
1971	147.8	8.5	30.6	24.3	9.2	3.9	5.1	10.8	6.8	1.0
1972	151.4	10.2	31.4	24.8	9.8	4.0	4.7	9.9	6.3	1.3
1973	150.5	10.8	30.9	24.2	9.6	4.3	4.8	9.6	5.6	1.1
1974	151.3	11.7	31.1	24.7	9.2	4.8	4.7	9.0	5.6	1.3
1975	146.2	12.1	30.3	22.4	8.8	4.0	4.3	8.8	4.7	1.2
1976	145.0	12.4	29.9	22.6	9.1	4.4	4.4	8.5	4.4	1.3
1977	146.1	13.9	30.6	22.7	9.1	3.8	4.4	7.4	4.8	1.2
1978	146.7	15.0	29.5	22.7	9.0	4.5	4.6	7.4	4.7	1.3
1979	149.6	16.2	29.8	23.2	9.1	4.4	4.3	7.1	4.2	1.2
1980	148.1	17.0	29.6	22.2	8.6	4.6	4.2	6.8	3.7	1.2
1981	148.6	17.9	30.1	21.5	8.5	4.5	4.1	7.5	3.9	1.3
1982	148.8	19.5	29.7	20.3	8.8	4.9	4.1	6.7	3.9	1.5
1983	148.7	19.9	30.3	19.9	8.2	4.9	4.2	6.5	3.9	1.5
1984	151.2	22.1	30.7	20.4	8.7	4.7	4.0	5.7	3.5	1.5
1985	154.1	23.7	31.8	19.7	8.5	5.0	3.8	6.0	3.3	1.6
1986	153.6	23.9	31.9	19.6	8.2	5.1	3.6	6.1	3.2	1.3
1987	153.4	25.3	31.3	19.5	8.2	5.2	4.1	5.7	3.0	1.5
1988	154.9	26.8	31.4	18.7	8.4	5.0	3.6	5.1	3.0	1.3
1989	152.7	27.0	31.3	17.6	8.1	5.5	3.7	5.5	2.9	1.4
1990	152.9	27.6	31.3	17.7	8.1	5.5	3.9	5.0	3.0	1.2
1991	153.4	29.5	30.1	16.8	7.9	5.7	3.5	4.9	2.8	1.4
1992	152.4	29.6	30.4	16.6	7.8	5.5	3.5	4.8	2.4	1.5
1993	153.5	31.5	29.2	16.5	8.0	5.5	3.4	4.5	2.6	1.5
* 1994	153.3	32.1	29.8	15.7	7.7	5.8	3.4	4.4	2.4	1.4
* 1995	153.3	33.0	29.6	15.2	7.6	5.9	3.3	4.3	2.3	1.4
* 1996	153.3	34.0	29.4	14.8	7.6	6.0	3.3	4.1	2.2	1.4

* Estimated Rates

Note: Rates exclude non-melanoma skin cancer (ICD-9 173) and are standardized to the age distribution of the 1991 Canadian population.

Source: Health Statistics Division, Statistics Canada.

Figure 5
Average Annual Percent Change in Age-Standardized Incidence (1984-1991)
and Mortality (1984-1993) Rates for Selected Cancer Sites, Canada



Note: See Table 10 for percent change for all sites.

Source: Health Statistics Division, Statistics Canada.

Table 10

Average Annual Percent Change in Age-Standardized Incidence (1984-1991) and Mortality (1984-1993) Rates for Selected Cancer Sites, Canada

	Incidence 1984-1991		Mortality 1984-1993	
	Males	Females	Males	Females
All Cancers	0.5 **	0.3	-0.3	0.0
Oral	-1.8 **	-1.0	-1.0 *	-1.5 *
Stomach	-2.3 **	-3.3 **	-3.8 **	-3.0 **
Colorectal	-0.6 *	-1.7 **	-1.5 **	-2.6 **
Pancreas	-2.5 **	-0.5	-1.8 **	-0.5
Larynx	-1.6 *	1.2 **	-0.4	-0.9
Lung	-0.7 *	3.5 **	-0.2	3.8 **
Melanoma	2.7	0.6	1.7	-0.2
Female Breast	...	1.6 **	...	-0.6 *
Cervix	...	-3.2 **	...	-3.4 **
Body of Uterus	...	-1.7 **	...	-1.5 *
Ovary	...	-1.3	...	-1.0 **
Prostate	4.1 **	...	1.2 **	...
Testis	3.2 *	...	-6.5 **	...
Bladder	-2.3 **	-2.2 *	-1.4 *	-1.1
Kidney	2.5 **	2.3 *	0.3	0.3
Brain	0.4	-0.1	-1.1 *	-0.7
Non-Hodgkin's Lymphoma	2.2 **	1.5 **	1.4 **	1.9 **
Hodgkin's Disease	-1.6	0.7	-4.8 **	-2.7 *
Multiple Myeloma	-0.3	-0.6	0.6	0.6
Leukemia	-1.4 *	-0.9	-1.5 **	-1.1 *

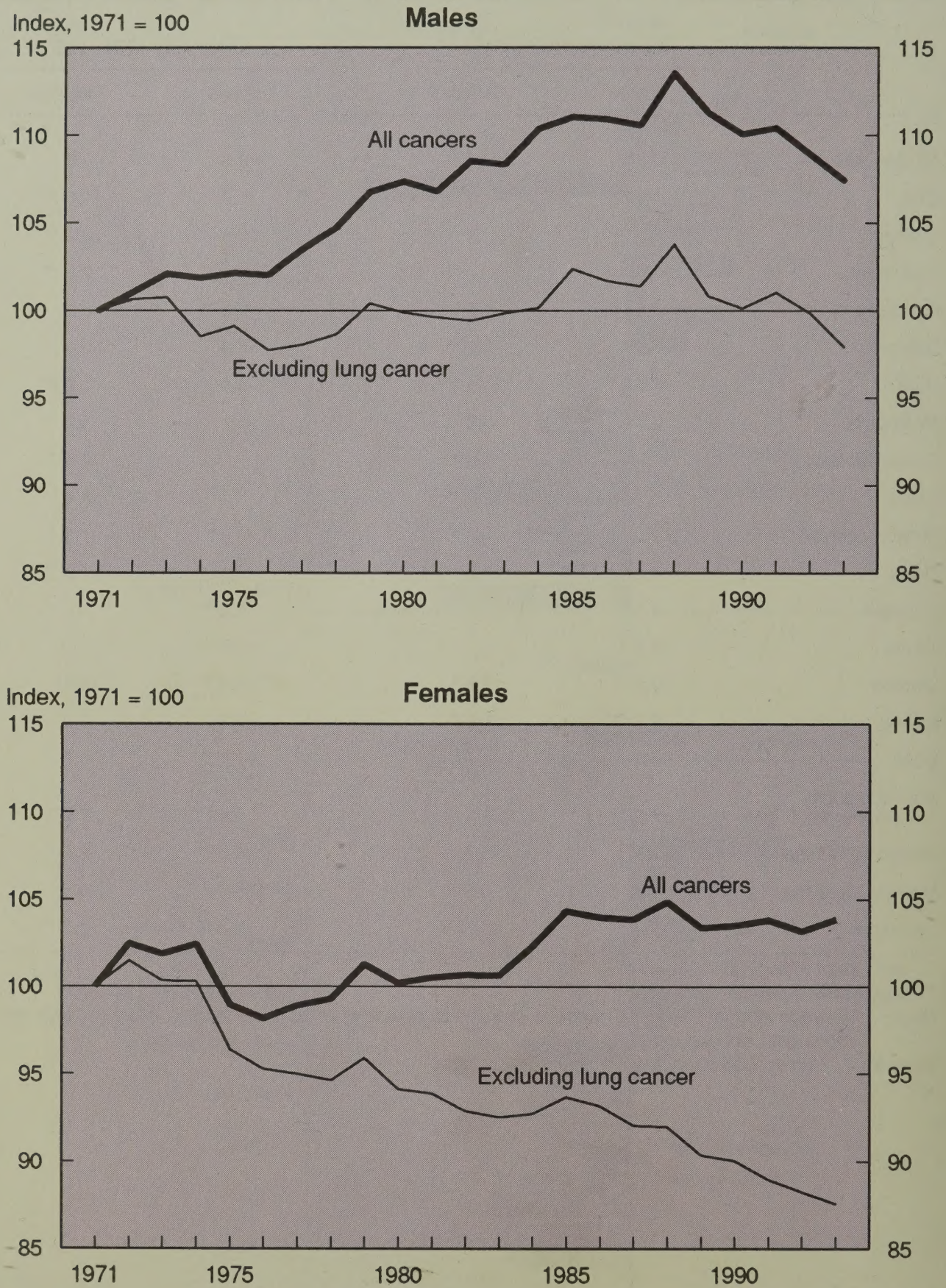
* significant at $p=0.05$

** significant at $p=0.01$

Note: Average Annual Percent Change is calculated assuming a log linear model; rates exclude non-melanoma skin cancer (ICD-9 173).

Source: Health Statistics Division, Statistics Canada.

Figure 6
Index of Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1971-1993



Note: Rates are standardized to the age distribution of the 1991 Canadian population; all figures exclude non-melanoma skin cancer (ICD-9 173). See also the Glossary and Appendix I: Methodology.
Source: Health Statistics Division, Statistics Canada.

AGE AND SEX DISTRIBUTION OF CANCER

This section shows estimates for 1996 by ten-year age groups for all sites combined (Table 11) and for the four leading types of cancer (Table 12). Trends in rates for cancer incidence and mortality by ten-year age groups shown in Figure 7 are plotted in a semi-logarithmic scale to illustrate both the increase in rates with age as well as the relative changes in rates over time.

Cancer is primarily a disease of elderly Canadians. Estimates for 1996 shown in Table 11 indicate that 59,300 (45%) of new cases and 34,900 (56%) of cancer deaths occur in Canadians aged 70 years or more, while an additional 33,700 (26%) new cases and 15,000 (25%) deaths occur in those aged 60-69. By contrast, just 1% of new cases and only 0.4% of deaths occur prior to age 20. Estimates for leading sites presented in Table 12 show that close to 50% or more of all newly diagnosed cancers of the lung, prostate, and colon and rectum occur among Canadians aged 70 or more. This is especially true for prostate cancer, with 65% of cases (and 81% of deaths) occurring in men over 70. Female breast cancer, however, occurs more frequently at earlier ages, with women aged 40-59 accounting for about one-third of new cases of breast cancer, those aged 60-69 for about one-quarter, and women aged 70 or older for another third.

Trends since 1969 in rates of incidence and mortality for all cancers by ten-year age groups are graphed using a semi-logarithmic scale and showing both actual and estimated rates (Figure 7). Cancer incidence and mortality increased substantially with age in both sexes. Incidence rates are 100-200 times greater in Canadians aged 80 or more compared to those aged under 20 years, while mortality rates compared for the same age groups are 400-500 times greater in women and about 700 times greater in men. Although incidence rates are somewhat higher in women than in men between 20 and 59 years of age, for all other age groups incidence is higher among men. The change in sex ratio for older men is due to the higher incidence of cancers of the breast and genital organs in women of reproductive age, and the higher incidence of most types of cancer in older men.

Since 1984 increases in cancer incidence have occurred primarily in Canadians aged 60-79, whereas cancer mortality has risen only among 60-79-year-old women, remaining stable for similarly-aged men. For Canadians aged 80 or more, both cancer incidence and mortality have been stable since 1984. At least some of the increases in incidence rates in the 1970s in men and women aged 80 and over is due to improved cancer registration in the elderly, particularly with respect to cases first discovered through death certificates.

Most encouraging are the steady declines since 1969 in mortality occurring among both Canadian men and women in all age groups under 60 years. Mortality rates generally declined substantially since 1969 among Canadians aged 0-29 (although rates for women aged 20-29 have been relatively flat since 1984), while declines were more moderate in those aged 30-49. Among 50-59-year-old men and women, decreases in mortality rates have occurred primarily since the mid-to-late 1980s.

Table 11
Estimated New Cases of Cancer and Cancer Deaths by Age Group and Sex,
Canada, 1996

Age Group*	Population (000s) 1996 Estimates			New Cases 1996 Estimates			Deaths 1996 Estimates		
	Total	M	F	Total	M	F	Total	M	F
0-19	8,004	4,098	3,906	1,350	730	630	240	140	100
20-29	4,235	2,143	2,092	1,700	820	890	250	130	120
30-39	5,284	2,667	2,616	4,500	1,700	2,800	990	400	590
40-49	4,532	2,267	2,265	10,600	3,900	6,700	3,200	1,400	1,800
50-59	2,999	1,497	1,502	18,100	8,700	9,400	7,300	3,900	3,400
60-69	2,340	1,131	1,209	33,700	19,700	14,000	15,000	8,800	6,200
70-79	1,684	721	963	38,000	22,100	15,900	19,700	11,200	8,500
80+	837	283	553	21,300	11,000	10,300	15,200	7,600	7,600
All Ages	29,914	14,807	15,107	129,200	68,600	60,600	61,800	33,600	28,200

* Age groupings are for a variable number of years.

Note: Figures exclude non-melanoma skin cancer (ICD9-173).
Totals may not add due to rounding. Please refer to Appendix I: Methodology for further details. 1996 population projections were provided by the Census and Demographics Branch, Statistics Canada.

Source: Health Statistics Division, Statistics Canada.

Table 12
Estimated New Cases and Deaths for Selected Cancer Sites by Age Group
and Sex, Canada, 1996

Age Group*	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
0-19	10	5	5	10	5	5	..	..
20-29	20	10	10	45	15	30	5	80
30-39	145	45	100	195	100	95	5	900
40-49	1,000	470	530	870	500	370	85	3,100
50-59	3,050	1,850	1,200	2,280	1,350	930	1,150	3,500
60-69	6,600	4,200	2,400	4,250	2,600	1,650	5,300	4,400
70-79	6,700	4,200	2,500	5,000	2,700	2,300	7,800	4,300
80+	2,580	1,650	930	3,600	1,500	2,100	3,900	2,200
All Ages	20,000	12,400	7,600	16,300	8,800	7,500	18,200	18,600
Deaths								
0-19	5	5	..	..	..	..	..	..
20-29	10	5	5	5	..	5	5	15
30-39	110	40	70	55	35	20	..	190
40-49	720	370	350	230	130	100	15	590
50-59	2,310	1,400	910	650	410	240	110	810
60-69	5,100	3,400	1,750	1,400	870	540	700	1,150
70-79	5,900	3,900	2,000	1,950	1,100	860	1,600	1,400
80+	2,800	1,850	970	1,850	770	1,100	1,800	1,150
All Ages	17,000	11,000	6,000	6,200	3,300	2,900	4,200	5,300

* Age groupings are for variable number of years.

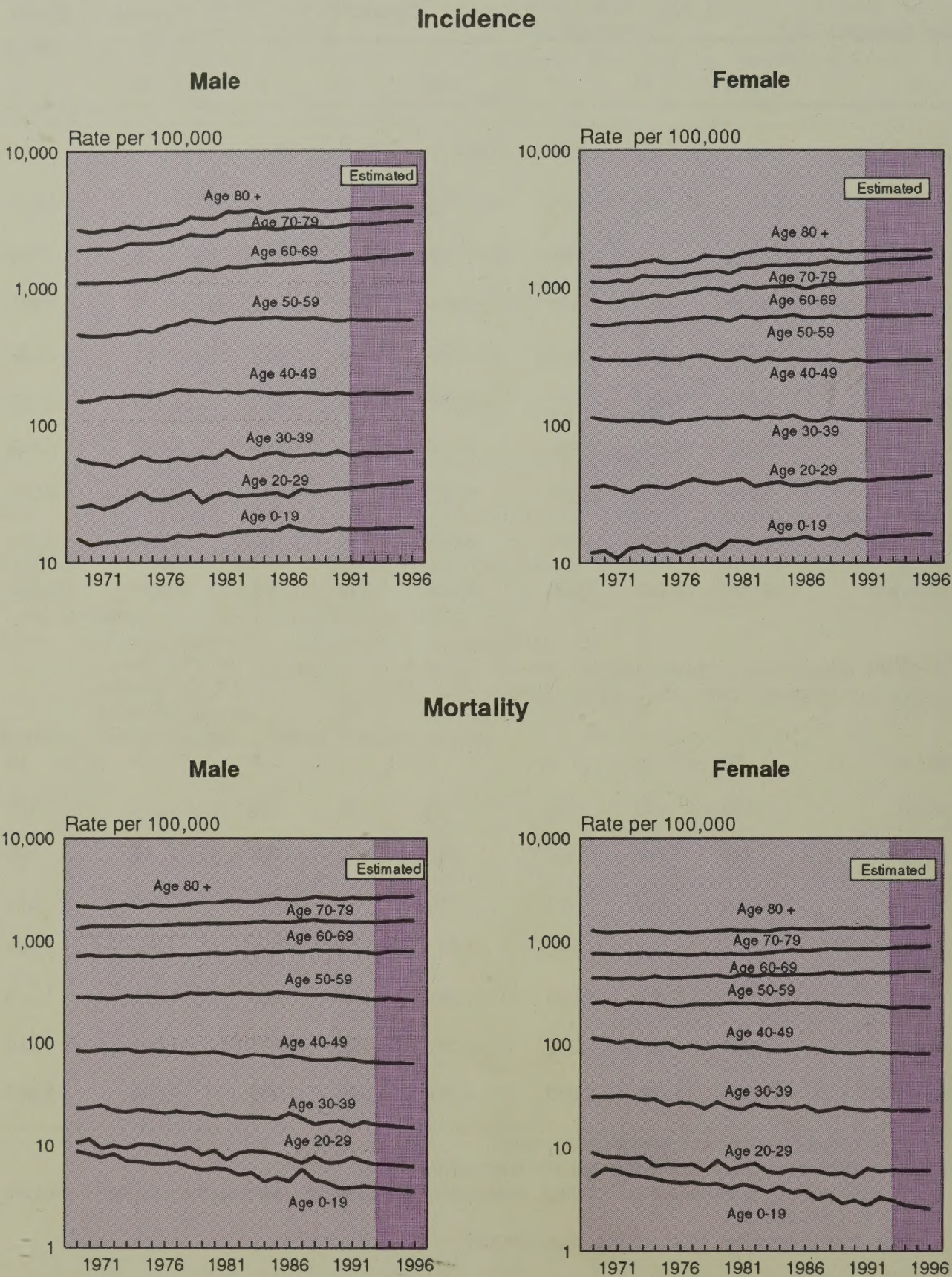
Notes: Figures exclude non-melanoma skin cancer (ICD9-173).

Totals may not add due to rounding. Please refer to Appendix I, Methodology for further details.

.. Less than 5.

Source: Health Statistics Division, Statistics Canada.

Figure 7
Age-Specific Incidence and Mortality Rates, All Cancers, 1969-1996



Source: Health Statistics Division, Statistics Canada.

PROBABILITY OF DEVELOPING/DYING FROM CANCER

Table 13 presents the probability (expressed as a percent) of Canadians developing various cancers by specific ages, as well as the lifetime probability of dying from one of the cancers. In addition, the inverses of the probabilities are presented. For example, for all cancers, men have a lifetime probability of 0.416 (41.6%) of developing cancer, while the inverse of that probability is 2.4, i.e., 41.6% of males, or 1 in 2.4 males, will develop cancer at some point in their lives. Similarly, women have a lifetime probability of 37.1% of developing cancer, or 1 in 2.7 females will develop cancer at some point during their lives. Approximately, 1 in 4 males and 1 in 5 females will die of cancer.

During their lifetimes, 1 in 9 women can be expected to develop breast cancer. The calculation of this probability considers birth to the end of life and represents the average of risks for an individual woman. For example, assuming the current rates of incidence and mortality, if 1,000 women are born, age together, and die, an average of 112, or 1 in 9, will have developed breast cancer during their lifetime. Of the same 1,000 women, 40, or 1 in 25, will have died from breast cancer. Similarly, 1 in 16 women will have developed colorectal cancer, 1 in 21 will have developed lung cancer, and 1 in 24 will have died from lung cancer.

While a man has just a 4% probability of developing prostate cancer by age 70, this increases to 8% by age 80. Over a lifetime, 1 in 9 men, or 11.6% will develop prostate cancer, and 1 in 27 will die from it. For lung cancer, 1 in 11 men will develop the cancer. Death will result from lung cancer for 1 in 12.

Figures 8.1 and 8.2 compare graphically the lifetime probabilities of developing and dying from cancer for males and females. The relative extent to which the probability of developing cancer exceeds the probability of dying from it reflects the prognosis of the cancer. Thus, if there is a substantially higher probability of developing a cancer than of dying from it, then a relatively large proportion of individuals must die of another cause. For example, the probability of developing lung cancer for both men and women approximates the probability of dying from it, thus indicating a relatively poor prognosis (i.e., low cure rate). For colorectal cancer on the other hand, the probability of developing the cancer far exceeds the probability of dying from it, indicating a better prognosis.

Table 13
Probability of Developing Cancer by Age, and Lifetime Probability of
Developing (1990-1992) and Dying (1993) from Cancer, Canada

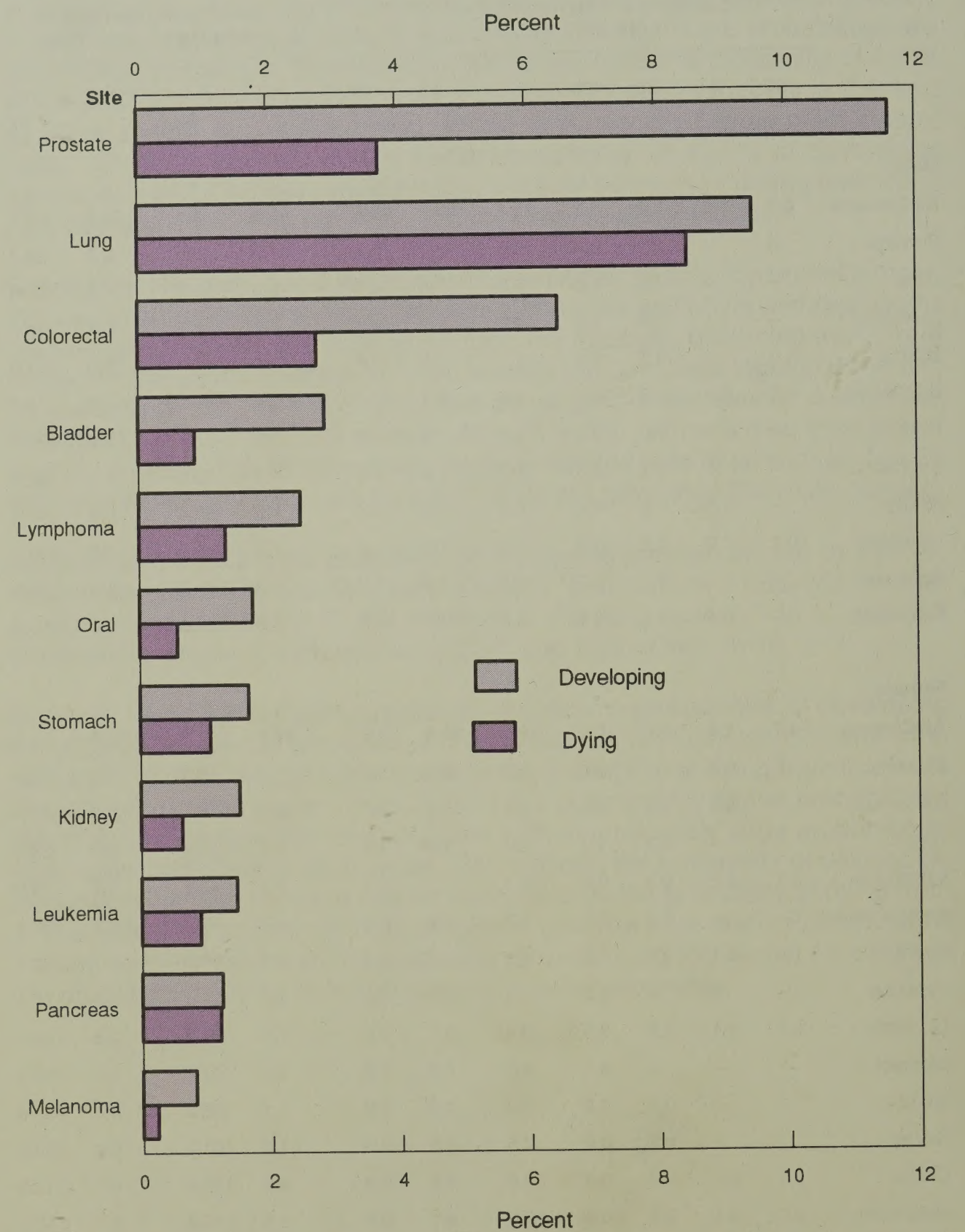
	Probability (%) of Developing Cancer by Age:							Lifetime Probability (all ages) of: Developing				Dying	
	30	40	50	60	70	80	90	(%)	One in:	(%)	One in:		
Male													
All Cancers	0.7	1.3	2.9	8.1	19.8	33.4	40.3	41.6	2.4	26.7	3.7		
Prostate	--	--	--	0.7	3.6	8.4	11.1	11.6	8.6	3.7	26.7		
Lung	--	--	0.3	1.5	4.5	7.8	9.3	9.5	10.5	8.5	11.8		
Colorectal	--	0.1	0.3	1.0	2.8	4.9	6.2	6.5	15.4	2.8	36.2		
Bladder	--	--	0.1	0.4	1.1	2.1	2.8	2.9	34.7	0.9	114.9		
Lymphoma	0.2	0.3	0.5	0.8	1.4	2.1	2.4	2.5	40.0	1.3	74.6		
Oral	--	--	0.2	0.5	1.0	1.4	1.7	1.8	57.1	0.6	169.5		
Stomach	--	--	0.1	0.3	0.7	1.2	1.6	1.7	59.5	1.1	92.6		
Kidney	--	0.1	0.2	0.4	0.8	1.2	1.5	1.5	65.4	0.6	156.3		
Leukemia	0.1	0.2	0.2	0.4	0.7	1.1	1.4	1.5	68.0	0.9	109.9		
Pancreas	--	--	0.1	0.2	0.5	0.9	1.2	1.2	80.6	1.2	82.6		
Melanoma	--	0.1	0.2	0.4	0.5	0.7	0.8	0.8	120.5	0.2	416.7		
Female													
All Cancers	0.7	1.8	4.6	10.2	18.8	28.5	35.0	37.1	2.7	22.4	4.5		
Breast	--	0.4	1.7	3.8	6.5	9.2	10.8	11.2	8.9	4.0	25.3		
Colorectal	--	0.1	0.3	0.9	2.1	3.9	5.7	6.2	16.1	2.7	36.5		
Lung	--	--	0.3	1.0	2.4	3.9	4.5	4.7	21.4	4.2	23.9		
Lymphoma	0.1	0.2	0.3	0.6	1.1	1.7	2.2	2.3	43.5	1.3	76.9		
Body of Uterus	--	--	0.2	0.6	1.3	1.9	2.2	2.3	43.7	0.5	196.1		
Ovary	--	0.1	0.3	0.5	0.9	1.3	1.5	1.6	63.3	1.1	92.6		
Pancreas	--	--	--	0.1	0.4	0.7	1.1	1.3	78.1	1.3	77.5		
Leukemia	0.1	0.1	0.2	0.3	0.4	0.7	1.0	1.1	87.7	0.8	133.3		
Stomach	--	--	--	0.1	0.3	0.6	0.9	1.0	101.0	0.7	135.1		
Bladder	--	--	0.1	0.2	0.3	0.6	0.9	1.1	95.2	0.4	250.0		
Kidney	--	--	0.1	0.2	0.5	0.8	0.9	1.0	101.0	0.4	250.0		
Cervix	0.1	0.2	0.3	0.5	0.6	0.8	0.9	0.9	113.6	0.3	312.5		
Melanoma	0.1	0.1	0.3	0.4	0.6	0.7	0.8	0.9	116.3	0.2	555.6		

-- Value <0.05.

Note: The probability of developing cancer is based on 1990-1992 data and calculated by selected age groups; the probability of dying from cancer is based on 1993 data. The probability for all ages is calculated from birth to the end of life.
 Non-melanoma skin cancer is excluded from the calculations. See Appendix I: Methodology for details.

Source: Cancer Bureau, Health Canada.

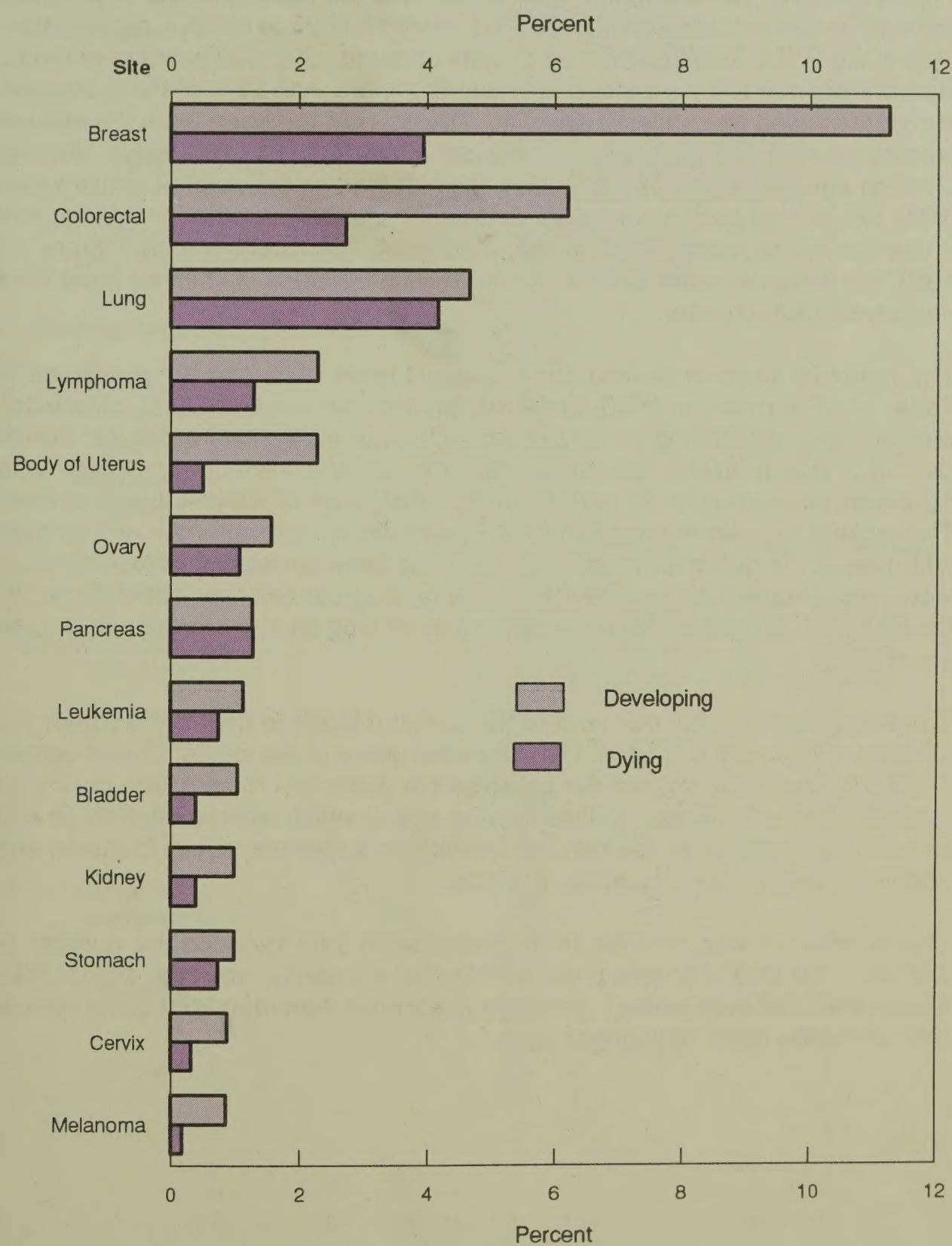
Figure 8.1
Lifetime Probability of Developing (1990-1992) and Dying (1993) from Cancer,
Males, Canada



Note: Lifetime probabilities are calculated from birth to the end of life, based on cancer incidence rates for 1990-1992.

Source: Cancer Bureau, Health Canada.

Figure 8.2
Lifetime Probability of Developing (1990-1992) and Dying (1993) from Cancer, Females, Canada



Note: Lifetime probabilities are calculated from birth to the end of life, based on cancer incidence rates for 1990-1992.
Source: Cancer Bureau, Health Canada.

POTENTIAL YEARS OF LIFE LOST DUE TO CANCER

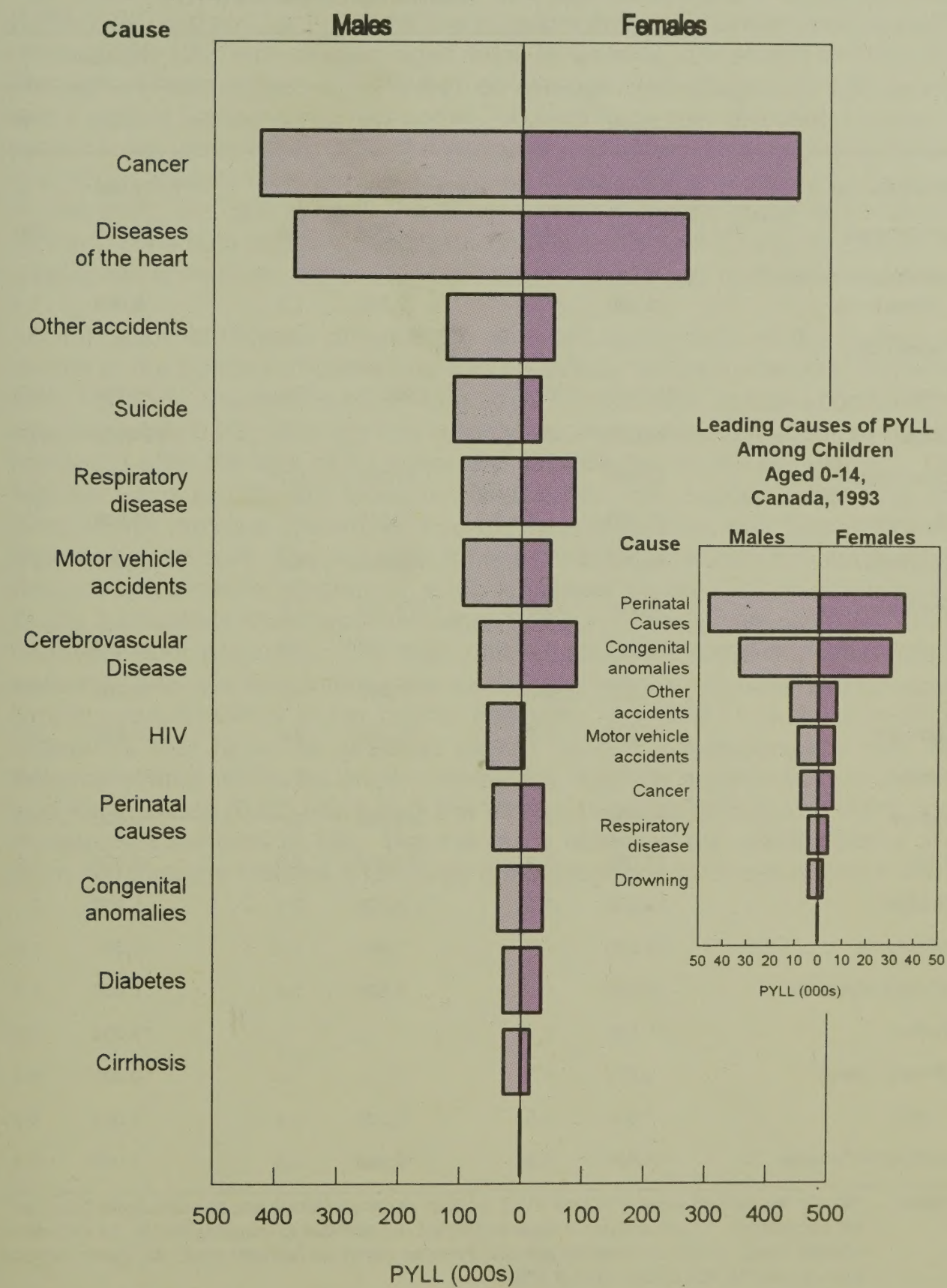
The twelve leading causes of potential years of life lost (PYLL) are ranked in Figure 9. This shows that in 1993, cancer was the leading cause of potential years of life lost in Canada. 873,000 PYLL were lost due to cancer, representing 28% of the PYLL resulting from all causes of death. 232,000 years of potential life lost were due to lung cancer, representing more than 26% of the premature mortality caused by cancer (Table 14). Diseases of the heart were the second leading cause of potential years of life lost at a total of 637,000 years. Among children aged 0-14, cancer ranked as the fifth leading cause of potential years of life lost behind perinatal causes, congenital anomalies, other accidents, and motor vehicle accidents. This ranking has been consistent in recent years. In 1993, the potential years of life lost due to cancer deaths in children aged 0-14 numbered 13,340 years.

The potential years of life lost due to various types of cancer are presented in Table 14. For males in 1993, the three leading cancers were lung, colorectal, and prostate, accounting for 50 percent of the potential years of life lost due to cancer. For females, the three leading cancers were lung, breast, and colorectal, accounting for 51 percent of potential years of life lost due to cancer. The ranking by relative importance of these cancers for both men and women with respect to potential years of life lost has been consistent in recent years. However, among women, the PYLL due to lung cancer now equal those for breast cancer, reflecting the increasing rates of lung cancer mortality in women aged 50-79.

The more common the cancer and the earlier it leads to death, the higher the premature mortality it causes. The potential years of life lost for breast cancer at 94,000 years far exceed the potential life years lost for prostate cancer at 33,000. This reflects the relatively young age at which women die from breast cancer. The potential years of life lost for Hodgkin's disease, a less common and relatively curable type of cancer, is 4,000.

The number of men who die from cancer each year exceeds the number of women. The loss of potential years of life for women is, however, higher than that for men, because women generally live longer than men, and some female cancer deaths occur at younger ages.

Figure 9
Leading Causes of Potential Years of Life Lost (PYLL), Canada, 1993



Note: Figures are presented in descending rank order of the 12 leading causes (both sexes combined).
Source: Cancer Bureau, Health Canada.

Table 14
Potential Years of Life Lost Due to Cancer, Canada, 1993

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
ALL CAUSES	3,078,000	...	1,707,000	...	1,371,000	...
All Cancers	873,000	100	424,000	100	449,000	100
Childhood Cancer (Ages 0-14)	13,000	1.5	7,000	1.7	6,000	1.4
Cancer Site						
Lung	232,000	26.6	138,000	32.5	94,000	20.9
Breast	94,000	10.8	...	...	94,000	20.9
Colorectal	82,000	9.4	41,000	9.7	41,000	9.1
Pancreas	41,000	4.7	20,000	4.7	21,000	4.7
Leukemia	36,000	4.1	19,000	4.5	17,000	3.8
Prostate	33,000	3.8	33,000	7.8	...	...
Non-Hodgkin's Lymphoma	32,000	3.7	16,000	3.8	16,000	3.6
Brain	31,000	3.6	17,000	4.0	14,000	3.1
Stomach	28,000	3.2	16,000	3.8	12,000	2.7
Ovary	25,000	2.9	...	...	25,000	5.6
Kidney	19,000	2.2	11,000	2.6	8,000	1.8
Oral	17,000	1.9	12,000	2.8	5,000	1.1
Bladder	14,000	1.6	9,000	2.1	5,000	1.1
Melanoma	13,000	1.5	7,000	1.7	6,000	1.3
Multiple Myeloma	13,000	1.5	6,000	1.4	7,000	1.6
Cervix	10,000	1.1	...	...	10,000	2.2
Body of Uterus	9,000	1.0	...	...	9,000	2.0
Larynx	7,000	0.8	6,000	1.4	1,000	0.2
Hodgkin's Disease	4,000	0.5	2,000	0.5	2,000	0.4

Note: Figures are ranked in order of total PYLL for both sexes combined and are calculated based on life expectancy. Count and percentage totals may not add due to rounding and to the exclusion of other sites. Childhood cancers are also included within the relevant sites. All figures exclude non-melanoma skin cancer (ICD-9 173).

... Not Applicable.

Source: Cancer Bureau, Health Canada.

CANCER IN CHILDREN AGED 0-14 YEARS

The number of new cases of cancer and age-standardized incidence rates (1988-1992) and number of deaths due to cancer and age-standardized mortality rates (1989-1993) for children aged 0-14, in Canada, are shown in Table 15. Throughout these periods, 837 children on average were diagnosed with cancer every year in Canada, and just under 200 died from their disease. Leukemia accounts for greater than 32% of new cases and 35% of deaths due to cancer in children, and remains the most common of the childhood cancers. Cancers of the brain and spinal cord, the second most common group of childhood cancers, constitute approximately 21% of new cases and 27% of deaths, while lymphomas account for almost 12% of new cases and just under 6% of deaths.

An indication of disease prognosis is provided by the ratio of the number of deaths to the number of cases and can be calculated using the data available from Table 15. The deaths to cases ratio for all childhood cancers combined is approximately 0.22, although this is likely an underestimation because deaths occurring after the age of 14 years are not included in the calculation. The highest ratios (>0.25) are found in children with liver cancer, tumours of the sympathetic nervous system, particularly neuroblastoma, and tumours of the brain and spinal cord. The high ratio for neuroblastoma reflects the fact that this disease is frequently diagnosed at an advanced stage. Soft tissue tumours (0.23), particularly rhabdomyosarcoma (0.24) and the leukemias (0.24), have relatively poor prognosis. The high ratio observed in acute non-lymphocytic leukemia (0.43) partially inflates the much lower ratio (0.15) observed for acute lymphocytic leukemia in the overall estimate. However, it is the non-acute leukemias that have the greatest impact on the deaths-to-cases ratio for leukemia overall. While the lymphomas have a relatively good prognosis overall, Hodgkin's disease (0.02) has a very low deaths-to-cases ratio compared to non-Hodgkin's lymphoma (0.16). The low ratios observed for retinoblastoma and germ cell tumours indicate a relatively good prognosis for these tumours too.

Table 15

New Cases and Age-Standardized Incidence Rates (1988-1992) and Deaths and Age-Standardized Mortality Rates (1989-1993) by Histologic Cell Type of Cancer for Children Aged 0-14, Canada

Diagnostic Group ²	New cases		ASIR	Deaths		ASMR
	(1988-1992 ¹)		per	(1989-1993)		per
	Number	%	1,000,000	Number	%	1,000,000
Leukemia	1361	32.5	47.3	320	35.2	11.01
Acute lymphocytic	1106	26.4	38.4	162	17.8	5.57
Acute non-lymphocytic	150	3.6	5.2	65	7.1	2.23
Lymphoma	490	11.7	17.1	52	5.7	1.79
Hodgkin's diseases	184	4.4	6.4	4	0.4	0.14
Non Hodgkin's lymphoma	147	3.5	5.1	24	2.6	0.83
All other lymphomas	153	3.7	5.3	24	2.6	0.83
Brain and Spinal	892	21.3	31.0	246	27.0	8.46
Astrocytoma	431	10.3	15.0	48	5.3	1.65
Medulloblastoma	192	4.6	6.7	49	5.4	1.68
Sympathetic Nervous System	319	7.6	11.1	110	12.1	3.78
Neuroblastoma	308	7.4	10.8	109	12.0	3.75
Retinoblastoma	104	2.5	3.6	2	0.2	0.07
Renal Tumors	244	5.8	8.5	23	2.5	0.79
Wilm's tumour	232	5.5	8.1	18	2.0	0.62
Hepatic Tumors	52	1.2	1.8	20	2.2	0.69
Bone	172	4.1	6.0	36	4.0	1.24
Osteosarcoma	92	2.2	3.2	21	2.3	0.72
Ewing's sarcoma	68	1.6	2.4	10	1.1	0.34
Soft Tissue	264	6.3	9.2	62	6.8	2.13
Rhabdomyosarcoma	143	3.4	5.0	35	3.8	1.20
Germ Cell	127	3	4.4	6	0.7	0.21
Epithelial	138	3.3	4.8	16	1.8	0.55
Other Cancers	20	0.5	0.7	17	1.9	0.59
Total (5 years)	4183	100	146.3	910	100.0	31.29
<i>Average per year</i>	<i>837</i>			<i>182</i>		

¹ Data are shown for the most recent five-year period available and exclude non-melanoma skin cancer (ICD-9 173) and in-situ carcinomas (ICD-9 230-234). Data are grouped according to the International Classification Scheme for Childhood Cancer, World Health Organization. Rates are age-standardized to the 1991 Canadian population and are expressed per million children.

² Only major subcategories within each group are included.

Note: Incidence data were provided by the Childhood Cancer Surveillance and Control Program, Health Canada and are not directly comparable to previous years. These data should also be quoted with caution as they are subject to ongoing validation and revision.

Source: Cancer Bureau, Health Canada and Health Statistics Division, Statistics Canada.

PROSTATE CANCER

Since the beginning of this decade, prostate cancer has surpassed lung cancer to become the most commonly diagnosed cancer in Canadian men.¹⁴ It ranks second to lung cancer as a cause of cancer death. In 1996, an estimated minimum 18,200* new cases of prostate cancer will be diagnosed in Canadian men (Table 1), compared with 12,400 new cases of lung cancer, 8,800 cases of colorectal cancer, and 18,600 cases of female breast cancer. It is estimated that 4,200 deaths from prostate cancer will occur in Canada in 1996; there will be 11,000 male deaths from lung cancer, 3,300 male deaths from colorectal cancer and 5,300 deaths for female breast cancer.

The age-specific incidence and mortality rates for prostate cancer between 1969 and 1996 show that incidence and mortality increase with advancing age and have increased over time in most age groups (Figure 10). While men in the 50-59-year age group have low, stable rates of incidence and mortality over time, those in the age groups 60-69 and 70-79 show steady increases in incidence while maintaining relatively stable rates of mortality. In the 80+ age group, rates of incidence and mortality both show an increasing trend.

The age-standardized incidence and mortality rates for prostate cancer in Canada and the United States (U.S.) between 1969 and 1993 illustrate that in both countries, mortality rates are relatively stable while incidence rates are increasing steadily over time (Figure 11). While the mortality rates for both Canada and the U.S. were essentially equal over the time period, incidence rates in the U.S. have increased more sharply since 1989 than the rates in Canada.

The gap between incidence and mortality rates is increasing over time, suggesting that prostate cancer is being detected earlier or treated more effectively.¹⁴

Currently, 1 in 9 Canadian men will develop prostate cancer during their lifetime (Table 13; Figures 8.1, 8.2), while 1 in 27 men will die of the disease. In 1993, prostate cancer accounted for 3.8% of the potential years of life lost due to cancer in men (Table 14).

Geographic Variation

A comparison of the age-standardized incidence rates of prostate cancer by province in 1991 shows that British Columbia had the highest rate, followed by Manitoba and New Brunswick (Figure 12). The highest mortality rate occurred in Prince Edward Island. Generally, geographical differences in mortality are much smaller than the geographical differences in incidence.

* Current rates for prostate cancer are likely underestimated because they do not fully account for the impact of prostate specific antigen (PSA) testing in the 1990s.

Incidence rates for prostate cancer in Canada and the provinces/territories fall below those for the U.S. and especially blacks in the U.S., for whom the rates are the highest quoted in the world (Figure 13). The Canadian rate is comparable to that for Sweden but exceeds those for other western European countries. Canadian rates are as much as ten times as large as those reported for the Southeast Asian and African countries. The age-standardized incidence rates reported for the Canadian provinces between 1983 and 1987 were similar, showing a small west-to-east gradient with the higher rates in the western provinces and the lower rates in the Atlantic provinces.

Trends in Prostate Cancer

Prostate cancer is an important public health problem because it commonly occurs in elderly men,¹⁶ and the Canadian population is increasingly aging. A range of investigations, including digital rectal examination, transrectal ultrasonography, determination of the prostate specific antigen (PSA) level, and magnetic resonance imaging have been given consideration for the early detection of prostate cancer.⁴ The use of PSA testing for both diagnostic and screening purposes in the detection of prostate cancer has shown a marked increase in Canada in this decade.¹⁴ Prior to 1990, PSA was hardly used in this country for diagnostic purposes. However, a national survey conducted in January, 1995 by Health Canada, the National Cancer Institute of Canada, and the Institute for Clinical Evaluative Sciences in Ontario found that overall, 15% of Canadian men over age 40 have had a PSA test since 1990. Of these, 60% (9% of the total) had the test performed for screening purposes. Furthermore, considerable regional variation occurs in the use of PSA for diagnosis or screening (Health Canada - unpublished data). Overall, in Canada, it appears that the relatively sudden increase in incidence of prostate cancer since 1990, as well as a component of the interprovincial variation, is predominantly the result of increased early detection using PSA.¹⁴ Part of the rise in incidence in the two decades prior to 1990, and, again, a component of the interprovincial variations, have been attributed to increased detection of cancers following transurethral resection of the prostate (TURP) for suspected benign, prostatic hypertrophy.¹⁵

Although part of the increased incidence may be attributed to early detection of the cancer, there has also been considerable effort to link the increasing rates of incidence with increases in the prevalence of risk factors for prostate cancer.¹⁴ The etiology of prostate cancer remains largely unknown despite studies concerning a number of factors.¹¹ The main known risk factors are age, race and family history. As well, various epidemiological studies have postulated a number of environmental factors as risk factors, including diet (particularly animal fat), occupational exposures such as cadmium, zinc and pesticides, hormone status, history of sexually transmitted diseases and vasectomy.^{14,13} However, with the exception of age, race, and family history, there has been limited substantive evidence supporting any risk factor as conclusively significant.^{14,13}

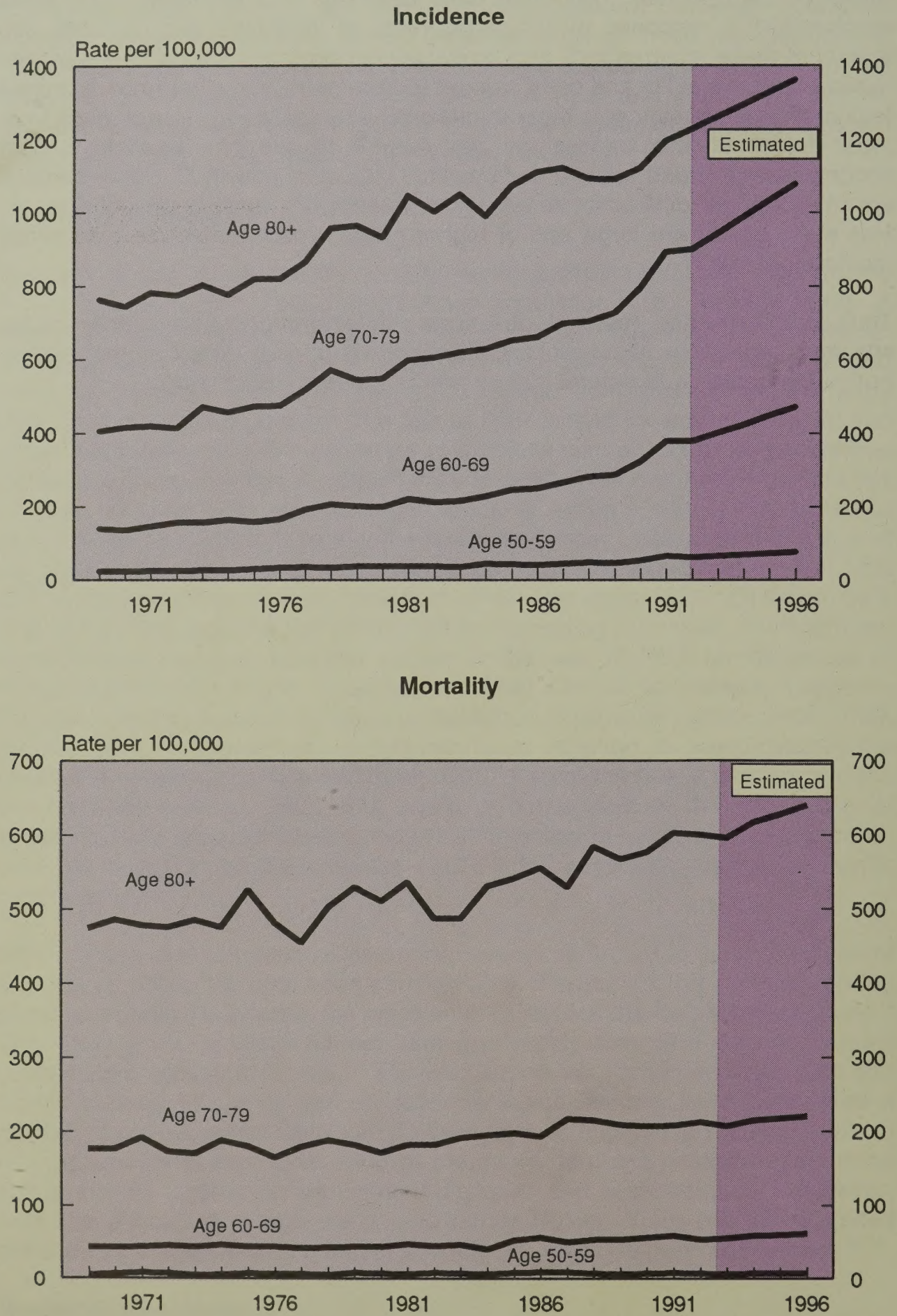
Research Directions

It is clear that the etiology, detection, diagnosis, and treatment of prostate cancer warrant further research in Canada. Although its causes are unknown, the

cancer is an important cause of both human suffering and health care expenditures.⁵ The early detection of prostate cancer remains of uncertain benefit,¹² and there is controversy about the most appropriate treatment of early forms of the disease.⁶ Although early detection and treatment have been emphasized in response to increasing rates of incidence and mortality, the impact of these interventions on survival is unknown, and concerns have been raised about morbidity and costs related to treatment.¹⁷ Furthermore, a unique feature of prostate cancer is that serious morbidity and death do not result from most forms of this cancer, as the natural history of prostate cancer encompasses a broad spectrum of possible biological activity.²⁵ Some cancers are small and well differentiated, with a low potential for causing clinical disease. However, others are large and of higher grade, and metastasize extensively leading to death.²⁵

Thus, for this disease, research questions persist throughout the cancer control spectrum – questions about etiology, effectiveness of early detection techniques, optimal therapies and natural history and prognostic determinants.

Figure 10
Age-Specific Incidence and Mortality Rates for Prostate Cancer, Canada, 1969-1996



Source: Health Statistics Division, Statistics Canada.

Figure 11
Age-Standardized Incidence and Mortality Rates for Prostate Cancer, Canada and the United States (U.S.), 1969-1993

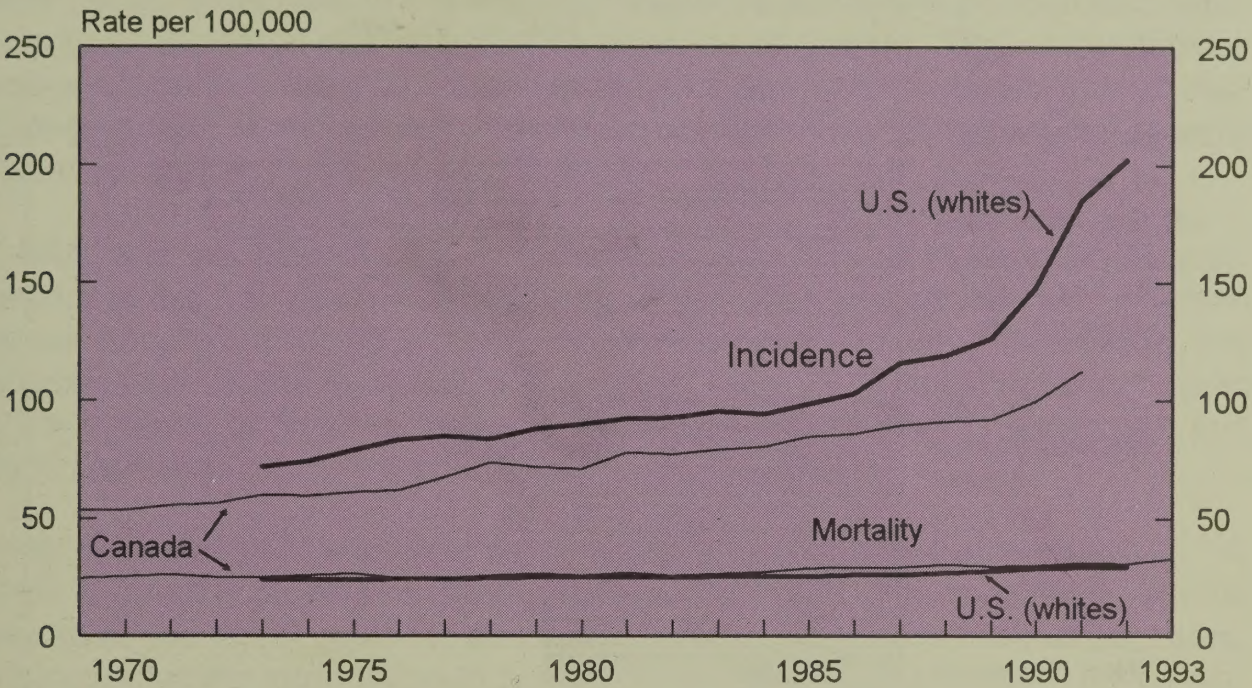
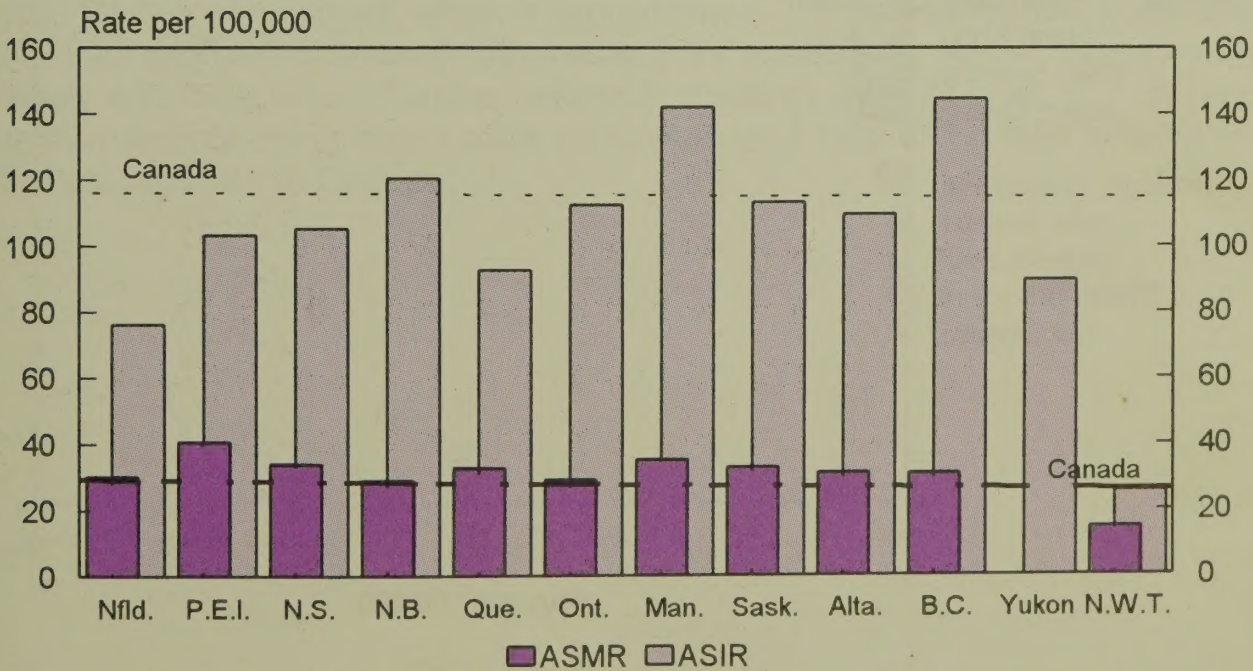


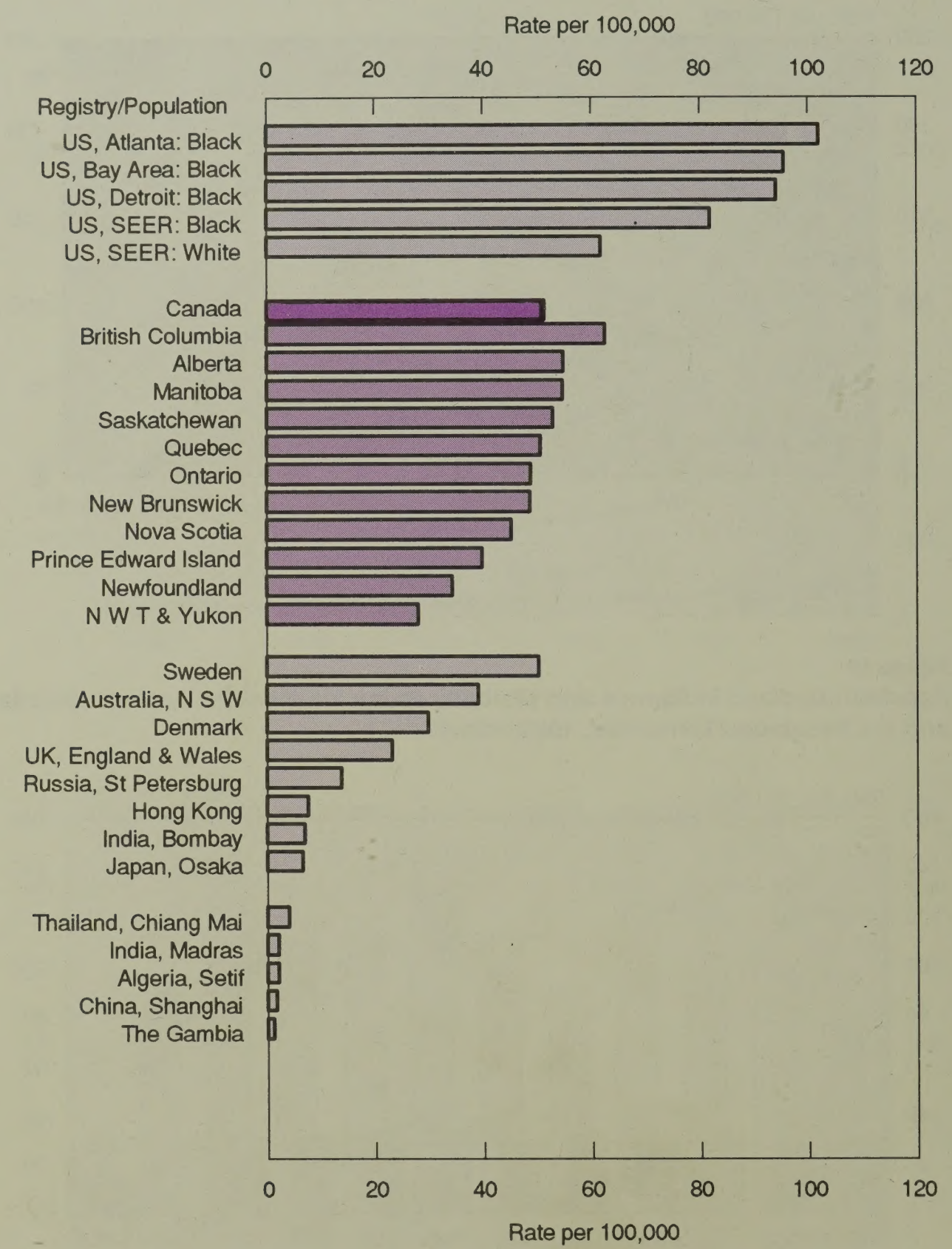
Figure 12
Age-Standardized Incidence and Mortality Rates for Prostate Cancer, Canada and the Provinces/Territories, 1991



Note: U.S. data are provided by the SEER program. Rates in both Figures 11 and 12 are standardized to the age distribution of the 1991 Canadian population. Deaths due to prostate cancer in Yukon are too low to produce an ASMR.

Source: Health Statistics Division, Statistics Canada.

Figure 13
Age-Standardized Incidence Rates for Prostate Cancer, Canada and Selected Populations, 1983-1987



Note: Rates are standardized to the age distribution of the World Standard Population.
 Figure includes registries with the highest and five lowest rates, plus selected populations with intermediate rates.

Source: Cancer Incidence in Five Continents, Vol. VI., International Agency for Research on Cancer.

DIRECT COSTS OF CANCER IN CANADA, 1993

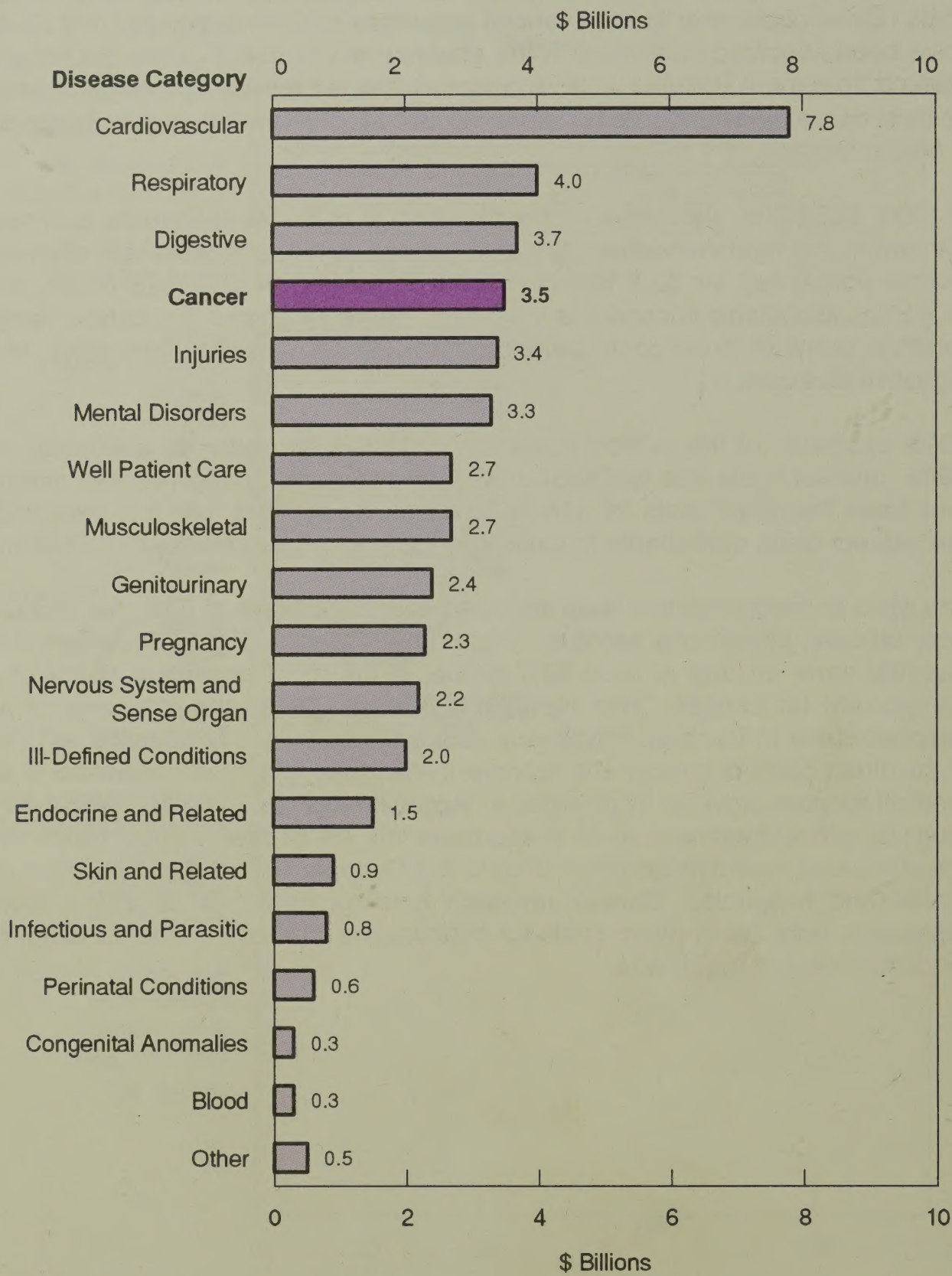
Cancer has a significant economic impact in Canada as measured by direct costs. Direct costs refer to the financial resources actually expended that could have been allocated elsewhere in the absence of disease. Figures quoted are derived from more detailed work in progress that will ultimately include indirect costs of cancer. Assumptions underpinning calculations are detailed in *Appendix I: Methodology*.

In 1993, \$68 billion was spent on the direct costs of illness in Canada. Sixty-six percent of this figure could be attributed to specific types of diseases, of which cancer accounted for \$3.5 billion. Of the remaining 34% or \$23 billion, the proportion attributable to cancer is unknown. Figure 14 shows that cancer ranks fourth in terms of direct costs, behind cardiovascular disease, respiratory, and digestive diseases.

1993 estimates of the indirect costs of cancer are not currently available. In 1986, indirect costs due to disability and premature death represented almost four times the direct costs for cancer.³¹ Assuming that this ratio has persisted, the indirect costs attributable to cancer in 1993 would be at least \$12.7 billion.

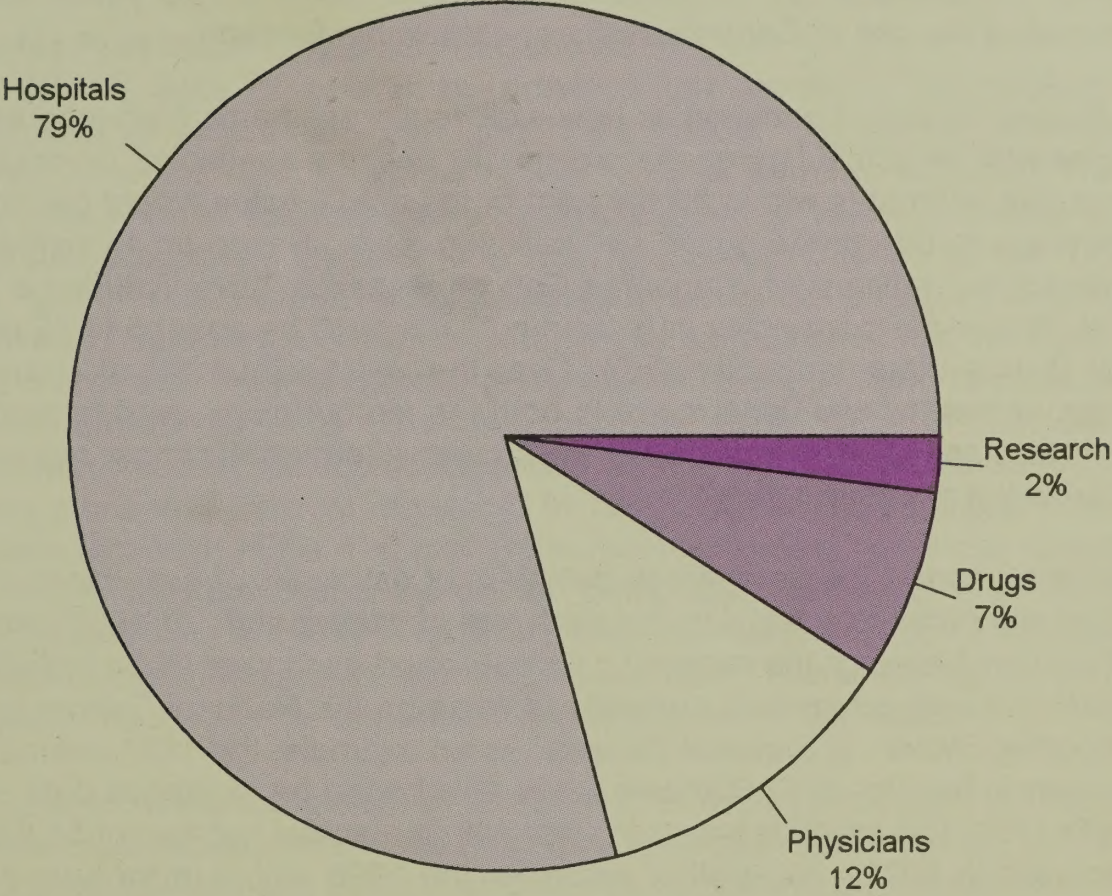
The types of direct costs that were attributed to specific types of diseases include hospital care, physician's services, drugs, and research. Figure 15 shows that hospital care, costing at least \$2.7 billion, is the most expensive direct cost component for cancer. This represents almost 11% of the total cost of all hospitalizations in Canada. Physicians services account for \$435 million (12%) of the direct costs of cancer and represent 4% of the total cost in Canada of all medical services provided by physicians. Approximately \$234 million is spent on drugs for cancer treatment, which is approximately 7% of direct cancer costs and 3% of the total cost of drugs distributed to the Canadian consumer through drug stores and hospitals. Cancer research funding, at a cost of \$72 million, represents only 2% of direct costs for cancer, and 15% of the total funding for medical research in Canada.

Figure 14
Direct Costs of Illness by Disease Category, Canada, 1993



Source: Cancer Bureau, Health Canada.
Note: See Appendix I: Methodology - Direct Cost of Cancer in Canada for further explanation of assumptions and calculations.

Figure 15
Direct Costs of Cancer in Canada, 1993



Source: Cancer Bureau, Health Canada.

Note: See Appendix I: Methodology - Direct Costs of Cancer in Canada for further explanations of assumptions and calculations.

EVALUATION OF CANCER ESTIMATES: 1987-1991

Estimates of the frequency of new cancer cases and deaths together with the corresponding age-standardized rates have been published in *Canadian Cancer Statistics* since 1987. Dissemination of current estimates each year addressed the need to provide timely information (given that the more detailed actual data were not available at the national level until three to five years later), and promoted the use of Canadian cancer data within Canada.

A frequently asked question is: how well do the estimates produced each year agree with the actual figures that eventually become available? An original goal was that estimates within 20 per cent of the actual value would be sufficiently accurate to inform the public and policy-makers. Based on an earlier study,⁸ subsequent editions of *Canadian Cancer Statistics* have included a footnote that "these estimates may vary from actual figures by about 5 to 15 per cent", but is this statement still valid? Over the years a number of changes and improvements have been made to both the methodology used to produce the estimates and the data provided by the provincial/territorial cancer registries. But what is the situation today?

Table 16 shows the percentage deviation of estimates of new cases of cancer when compared to actual data for each site of cancer and for each province for all cancers based on the rounded data published each year in *Canadian Cancer Statistics* and actual data currently residing on the National Cancer Incidence Reporting System at Statistics Canada. As an example, the 1991 estimate for all cancers in females of 51,600 new cases was based on incidence data available up to 1986. This estimate was 0.1% less than the actual number of 51,622 cases reported in 1991. As another example, the 1990 estimate for lung cancer in males in Canada was 11,800, which was 8.1% higher than the actual number (11,182) of lung cancers eventually reported.

Results by Site of Cancer for Canada

Overall, for most sites of cancer, there is good agreement between the actual and estimated figures at the Canada level, as just 15 of the 137 estimates vary by 15% or more, and only 4 of 137 by 20% or more. For all new cases of cancer occurring in Canada each year, results are consistently within 1-3%. Estimates are generally within $\pm 10\%$ for many forms of cancer, including cancers of the stomach, cervix, colon and rectum, pancreas, lung cancer (males), uterine body, ovary, lymphoma and leukemia.

Estimates of new cases of cancer for Canada that vary by more than $\pm 10\%$ often involve cancers for which the trends changed suddenly (and sometimes unexpectedly) during the 1980s. For example, estimates for prostate cancer from 1987-1991 were consistently 10-15% low, even though special models were used to account for a more rapid than linear growth; this reflects the rapid increases due to changes in the diagnostic procedures used for prostate cancer. Another example is melanoma, which was underestimated in both men and women in 1988, but was overestimated in 1991 for both sexes, reflecting a period of rapidly rising rates followed by a slower increase. Breast and lung cancers in women were underestimated in earlier years, but better results were

obtained when improved models were used starting in 1989 for lung cancer and 1990 for breast cancer. Cancer of the kidney has been one of the most rapidly increasing forms in recent years, and this rapid increase appears to have led to underestimation of counts between 1987 and 1990. The overestimation of bladder cancers by 15-20% since 1990 is primarily due to adjustments in rules used to code this cancer by one registry, which has considerably reduced the number of invasive bladder cancers that are now reported across Canada.

Results for Provincial Totals for All Cancers

Results for all sites of cancer by province can generally be related to improvements in registration throughout this period. Of the 88 estimates compared, 6 varied from the actual figures by 15% or more, including 3 that varied by 20% or more. Estimates were generally within $\pm 10\%$ for provinces with relatively stable registries; these include New Brunswick, Quebec (since 1981), Ontario, and Saskatchewan. Small numbers of cases are a major reason for higher levels of variation in provinces with smaller populations. For example, in 1987 the estimate for the total number of cancers in Newfoundland females was 620, which turned out to be 10% lower than the actual value of 689. Some problems were experienced in producing estimates for Prince Edward Island due to the low number of cancers registered in 1986, and slow reporting of data in earlier years (although PEI is now one of the most up-to-date provinces in terms of reporting). In Nova Scotia, the use of pathology reports (as of 1982) and death registrations (as of 1986) to register cases has led to significant increases in numbers of cases registered from 1985 onwards²⁶. This underregistration in earlier years resulted in the underestimations of over 30% in 1987.

Female cancers in Manitoba were overestimated in most years, but this result is largely artifactual because Manitoba has since replaced its data on the National Cancer Incidence Reporting System at Statistics Canada and recoded as *in situ* cancers a number of tumours of the cervix and female breast that were originally reported as invasive²⁶. Finally, the underestimation of cancers in Alberta and British Columbia in earlier years may result from the fact that the population projections used for 1987 and 1989 underestimated the growth in population, particularly among the elderly. These problems were addressed by using a population projection scenario that more adequately accounts for population growth in the West, and (since 1991) by using models that produce estimates separately for those aged under 45, and 45 and over.

Regular production and validation of the estimates produced serves to improve the quality of data available in several ways. First, timeliness of data reporting is encouraged, as data providers recognize that more up-to-date data will result in more accurate estimates. Second, incomplete reporting or changes in reporting can be detected for follow up with registries to encourage more consistent reporting. Third, reviews such as this can produce feedback that leads to changes in methodology and in the source data used for cancer incidence or populations and thereby improve the quality of estimates in future years. Fourth, differences between estimates and actual data can be used to detect important changes in trends, such as those which reflect changes in diagnostic practices (e.g., breast and prostate cancers).

Table 16.1
Percentage Difference between Estimated and Observed New Cases by Site,
and by Canada and Provinces, Males, 1987-1991

Site	1987	1988	1989	1990	1991	1991	
						Actual	Estimate
Percentage Difference							
All cancer	-1.6	-3.1	0.3	-1.6	-0.7	57,780	57,400
Oral	-7.2	-10.0	-5.6	-3.2	0.3	2,194	2,200
Stomach	-5.1	0.4	-0.7	-0.5	-0.2	1,904	1,900
Colorectal	-0.6	-2.2	2.6	3.4	5.7	7,664	8,100
Pancreas	6.7	3.7	7.4	8.1	4.6	1,386	1,450
Lung	1.4	1.8	6.0	5.3	8.1	11,288	12,200
Melanoma	...	-21.4	-6.2	-5.1	13.3	1,192	1,350
Prostate	-11.7	-13.3	-11.1	-9.5	-15.0	13,292	11,300
Bladder	4.4	2.0	9.0	16.1	15.8	3,282	3,800
Kidney	-16.2	-19.5	-15.8	-13.7	-6.2	1,919	1,800
Brain	...	-6.4	11.4	0.9	0.4	1,145	1,150
Lymphoma	-1.5	-4.2	-2.0	-8.8	-1.5	3,349	3,300
Leukemia	-5.8	3.2	2.9	4.7	1.9	1,767	1,800
Registry	1987	1988*	1989	1990	1991	1991	
						Actual	Estimate
Canada	-1.6	...	0.3	-1.6	-0.7	57,780	54,400
Nfld.	-4.1	...	-8.6	-7.7	-1.2	941	930
P.E.I.	-4.9	...	0.0	5.1	20.8	265	320
N.S.	-36.4	...	-10.6	-14.3	-11.2	2,139	1,900
N.B.	-11.1	...	-6.4	-5.7	3.6	1,545	1,600
Que.	1.0	...	7.3	2.0	-2.4	14,863	14,500
Ont.	5.2	...	0.1	0.4	0.2	21,663	21,700
Man.	2.5	...	0.3	2.9	-2.8	2,572	2,500
Sask.	4.1	...	5.1	4.3	7.1	2,240	2,400
Alta.	-7.7	...	0.8	1.3	2.3	4,104	4,200
B.C.	-14.6	...	-8.6	-6.3	0.4	7,368	7,400

* Provincial incidence estimates were not published for 1988.
Note: All percentage figures are calculated as follows: 100 (Estimated Cases - Observed Cases)/Observed Cases.
 ... - Not applicable.

Table 16.2
Percentage Difference between Estimated and Observed New Cases by Site, and by Canada and Provinces, Females, 1987-1991

Site	1987	1988	1989	1990	1991	1991	
						Actual	Estimate
Percentage Difference							
All cancer	-2.2	-5.0	-0.3	-1.4	-0.1	51,662	51,600
Oral	-3.4	0.3	-3.2	-3.2	5.8	822	870
Stomach	-4.6	2.7	1.0	1.6	10.7	1,039	1,150
Colorectal	1.4	3.0	6.7	6.3	11.6	6,900	7,700
Pancreas	-8.0	2.8	9.6	5.1	9.0	1,330	1,450
Lung	-13.5	-15.3	0.4	1.7	6.3	5,739	6,100
Melanoma	...	-3.8	8.4	15.8	20.9	1,282	1,550
Breast	-7.7	-15.7	-11.0	-5.0	-4.6	15,087	14,400
Cervix	...	...	6.0	-12.9	-14.5	1,403	1,200
Body of Uterus	1.7	0.9	9.9	9.8	7.9	2,872	3,100
Ovary	1.4	-4.8	8.0	-3.4	-2.4	2,049	2,000
Bladder	...	-1.4	12.5	17.5	18.8	1,136	1,350
Kidney	...	-26.0	-19.5	-15.2	3.8	1,204	1,250
Brain	...	3.2	10.8	-0.8	1.1	880	890
Lymphoma	1.2	0.5	-1.1	-3.8	-2.0	2,856	2,800
Leukemia	-3.5	0.1	4.6	-2.2	2.6	1,316	1,350
	1987	1988*	1989	1990	1991	1991	
						Actual	Estimate
Canada	-2.2	...	-0.3	-1.4	-0.1	51,662	51,600
Nfld.	-10.0	...	-16.0	-13.5	3.3	726	750
P.E.I.	13.2	...	7.4	1.1	-3.7	270	260
N.S.	-33.8	...	-15.8	-17.2	-10.4	1,897	1,700
N.B.	-11.2	...	-9.5	-8.5	-6.9	1,343	1,250
Que.	0.0	...	6.2	-1.4	-2.5	13,031	12,700
Ont.	4.6	...	-0.3	0.6	-0.3	20,167	20,100
Man.	14.8	...	9.0	17.9	10.2	2,268	2,500
Sask.	-3.0	...	4.7	-4.1	3.1	1,843	1,900
Alta.	-13.4	...	4.4	-2.6	2.8	3,697	3,800
B.C.	-14.2	...	-12.6	-5.3	3.8	6,357	6,600

* Provincial incidence estimates were not published for 1988.
Note: All percentage figures are calculated as follows: 100 (Estimated cases - observed cases)/observed cases.
 ... Not applicable.

GLOSSARY

Age: The age of the patient (in completed years) at the time of diagnosis or death.

ICD-9: The Ninth Revision of the International Classification of Diseases.³²

Incidence: The number of new cases of a given type of cancer diagnosed during the year.

The basic unit of reporting is a new case of cancer rather than an individual patient.

Mortality: The number of deaths attributed to the particular type of cancer and that occurred during the year.

Included are deaths of patients diagnosed in earlier years, persons newly diagnosed during the year, and patients for whom a diagnosis of cancer is made only after death.

**Province/
Territory:** For cancer incidence and mortality data, this is the province/territory of the patient's permanent residence at time of diagnosis or death, which may or may not correspond to the province/territory in which the new case of cancer or the cancer death was registered.

Incidence and Mortality Rates:

Crude rate

The number of new cases of cancer or cancer deaths during the year, expressed as a rate per 100,000 persons in the population.

Age-specific rate

The number of new cases of cancer or cancer deaths during the year, expressed as a rate per 100,000 persons in a given age group.

Age-standardized rate

The number of new cases of cancer or cancer deaths per 100,000 that would have occurred in the standard population (1991 Canadian population or World Standard Population) if the actual age-specific rates observed in a given population had prevailed in the standard population.

Index of small age-standardized rates

The age-standardized rate of the base year, 1971, is set at 100. Index values for subsequent years are derived by multiplying the age-standardized rate for the year by 100 and then dividing by the 1971 rate.

Site Definitions: Cancer data presented in this monograph are classified according to the following site groupings, except where otherwise noted.

Site	ICD-9	Site	ICD-9
Oral	140-149	Prostate	185
Stomach	151	Testis	186
Colorectal	153-154	Bladder	188
Pancreas	157	Kidney	189
Larynx	161	Brain	191-192
Lung	162	Lymphoma	200-203
Melanoma	172	Hodgkin's Disease	201
Female Breast	174	Multiple Myeloma	203
Cervix	180	Non-Hodgkin's	
Body of Uterus	179,182	Lymphoma	200, 202
Ovary	183	Leukemia	204-208
		All Cancers excluding Lung	140-208 excluding
		All Other Cancers	173, 162,
			All sites between
			150-199 not listed above
All Cancers	140-208 excluding 173		

1991 Canadian Population: The population used to standardize rates has the following age distribution.

Age Group	Population (weight)	Age Group	Population (weight)	Age Group	Population (weight)
0-4	6,946.4	30-34	9,240.0	60-64	4,232.6
5-9	6,945.4	35-39	8,338.8	65-69	3,857.0
10-14	6,803.4	40-44	7,606.3	70-74	2,965.9
15-19	6,849.5	45-49	5,953.6	75-79	2,212.7
20-24	7,501.6	50-54	4,764.9	80-84	1,359.5
25-29	8,994.4	55-59	4,404.1	85+	1,023.7
				TOTAL	100,000.0

Source: This population distribution is based on the final post-censal estimates of the July 1, 1991 Canadian population.

APPENDIX I: METHODOLOGY

Data Sources and Processing

The actual cancer incidence and mortality data used in this monograph were obtained from three sources: mortality data files (1969-1993), the National Cancer Incidence Reporting System (NCIRS, 1969-1991), and the Canadian Cancer Registry (CCR, 1992).^{26,27} These data bases are maintained by the Health Statistics Division at Statistics Canada. Actual mortality data were available for all of the provinces for the period 1969 to 1993. By contrast, actual cancer incidence data at the Canadian level were available for the period 1969-1991. In addition, 1992 incidence data were available for Prince Edward Island, Nova Scotia, Québec, Manitoba, Saskatchewan, and Alberta, while for New Brunswick, data were available for 1993, but not for 1992.

Records from each province were extracted and then classified by sex, age group, and selected cancer sites defined in the Glossary. Canada totals for selected sites were then determined as the sum of the ten provinces and adjusted where necessary to include the small number of counts for the territories. For Northwest Territories and Yukon, the 1987-1991 records were also extracted from these data bases to calculate a five year average of cancer incidence and mortality. These averages were used as 1996 estimates for these territories.

Population figures for Canada, provinces and territories were taken from intercensal estimates for the period 1969 to 1990,^{28,29} from postcensal estimates for the period 1991-1994,³⁰ and from the Scenario 2 population projections for 1995 and 1996.³⁰ These projections are based on the assumptions of natural increase, immigration and internal migration that most closely reflect the Canadian reality.³⁰ They are regularly updated to take into account the most recent changes. In 1993, following a decision of Statistics Canada to incorporate net census undercoverage in the Population Estimates Program, Demography Division proceeded to revise the population figures for the period 1971-1991.²⁹ Since then, current estimates and their corresponding projections include as part of the Canadian population non-permanent residents, plus adjustments to account for estimated net undercoverage of Canadian Censuses and returning Canadians. This change caused a slight reduction in age-standardized rates.³

Incidence and mortality estimates for 1996 were obtained from models that were fitted to a subset of the data described above. The data series were selected from the most recent year, and available data were used back to 1984. This provides for a maximum of 10 years of the most recent data for incidence and mortality, which more accurately account for current trends. Specifically, data from 1984 to 1991 (or from 1984 to 1992 for Prince Edward Island, Nova Scotia, Québec, Manitoba, Saskatchewan and Alberta, or from 1984 to 1991 plus 1993 for New Brunswick) were used to compute incidence estimates, and data from 1984 to 1993 for mortality estimates. For Nova Scotia, estimates were less accurate for some sites due in part to the use of data from years prior to 1986, when death certificates were not used as a source.²⁶ From 1992 onward, simpler models have been used than were employed in previous editions of *Canadian Cancer Statistics*, due to the availability of more recent, better quality data.

Actual crude incidence and mortality rates for each province/territory, sex, site and year were computed by dividing the number of cases by the corresponding provincial/territorial population figures. These rates were computed for the "under 45" and the "45 and over" age groups separately. In order to study the age distributions for

all cancers and for the leading types of cancer (lung, colorectal, prostate, and breast), age-specific rates were computed for the age groups 0-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80 years and over.

Age-standardized incidence and mortality rates for each site were calculated using the age distribution of the 1991 Canadian population. As the 1991 Canadian final postcensal estimates were available, they replaced the preliminary estimates used in the 1995 edition of *Canadian Cancer Statistics*. The rates established using one series or the other are completely comparable. The World Standard Population²¹ used in publications prior to 1995 was set aside because it is much younger than the 1991 Canadian population. Age-standardized rates calculated using the 1991 Canadian population are about 30 to 50 percent higher than those calculated using the World Standard Population. It is preferable to use the 1991 Canadian population, because the standardized rates more closely reflect the actual incidence rate per 100,000 Canadians.

Mortality Estimates (Deaths) for 1996

The number of deaths was estimated for each site and sex assuming a Poisson distribution, fitting maximum likelihood models to the provincial and Canadian yearly values. The yearly counts were assumed to follow independent Poisson distributions, with mean values equal to the product of yearly population sizes and crude yearly death rates. Crude mortality rates were modelled separately for the "under 45" and the "45 and over" age groups (or for the 0-19, 20-29, ... , 80 years and over age groups when the age distribution of a type of cancer was under study), to obtain corresponding predicted crude rates. These projected rates were then applied to the 1996 population projection figures to obtain the 1996 projected counts. For each province, sex and site, a linear model was used for death rates, with year as the only independent variable. Mortality counts by site for Canada were directly obtained from the counts for Canada as a whole. Provincial estimates were then adjusted so that their sum corresponded to the Canadian estimate.

Incidence Estimates (New Cases) for 1996

The number of new cases was estimated for each site and sex with a method similar to that used for mortality, with some exceptions reported in the next paragraph. For each province, sex and site, a linear model for crude incidence rates was used, with year as the only independent variable. The estimates were calculated separately for the "under 45" and the "45 and over" age groups (or for the 0-19, 20-29, ... , 80 years and over age groups when the age distribution of a type of cancer was under study). Since longer data series for some provinces were available, estimates for Canada were computed as the sum of the estimates for each province.

Occasionally, in some cases where the original data show large fluctuations, which is more likely to occur for less common cancers studied in a province with a small population size, it has been impossible to obtain from the model results of satisfactory precision. For these exceptions, new cases for 1996 were estimated by a five-year average: Newfoundland (1987-1991): pancreas (M), cervix (F), and brain (F); Prince Edward Island (1988-1992): lung (M and F); Manitoba (1988-1991): melanoma (M and F), larynx (M), cervix (F), and oral (M and F); and Saskatchewan (1988-1992): kidney (M), and stomach (F).

Estimated Age-Standardized Incidence Rates (ASIRs) and Mortality Rates (ASMRs) for 1996

Incidence and mortality rates were generally estimated using weighted least squares regression, with some exceptions as noted below. Weights were taken as the inverse of the estimated variances of the actual age-standardized rates. Variances were calculated under the assumption that the age-specific counts used in the computation of the age-standardized rates follow independent Poisson distributions. Regressions were performed for Canada and each province for each site and sex using a linear model, with year as the only independent variable.

Again, in some cases where the original data show large fluctuations, it has been impossible to obtain from the model results of satisfactory precision. For these reasons, age-standardized incidence rates were estimated by a five-year average for: Newfoundland (1987-1991): pancreas (M and F), brain (M and F), and cervix (F); Prince Edward Island (1988-1992): larynx and bladder (M), body of uterus, leukemia and brain (F), and lung (M and F); and Manitoba (1987-1991): oral (M and F), melanoma (M and F), and cervix (F).

Due to large fluctuations in the original data, the age-standardized mortality rate was estimated by a five-year average (1989-1993) for: Newfoundland: melanoma (M), and pancreas (F); Prince Edward Island: stomach (M), leukemia (M and F), kidney (M), brain (M), larynx (M), breast (F), and ovary; and Manitoba: larynx (M).

Accuracy and Precision of Estimates

The standard error and coefficient of variation were calculated to evaluate the precision of each estimate. These values are available upon request from the Health Statistics Division, Statistics Canada. Note that any estimates are subject to error, and the degree of precision depends on the adequacy of the model as well as the number of observed cases and population size for each site-sex-province combination.

Due to changes and improvements in the cancer incidence data provided by the provinces, as well as changes in the methodology for producing the estimates of cancer incidence and deaths, **estimates in the 1996 report may not be directly comparable to those published in previous years.** More detailed information on these methods can be found in technical papers available from the Statistics Canada.^{1,20} Also, changes in Statistics Canada's annual population estimates, introduced in 1993, have an effect on cancer incidence and mortality age-specific and crude rates, which become lower. A paper on the impact of the adjustment of the Canadian population data has just been published.³

Significant Differences Between the Canadian and Provincial ASIRs

Five-year ASIRs were calculated with the data from 1987 to 1991. Differences between the Canadian ASIR and the provincial ASIR were analyzed by computing a standardized test statistic (Z) for the difference between the two. If the absolute value of the calculated Z statistic was larger than the chosen critical point of the standard normal distribution, then a significant difference between the two age-standardized incidence rates was assumed to exist. To proceed with these calculations for every site and sex, it was assumed that the provincial ASIR was *not* independent of the Canadian rate, and the correlation between the rates was accounted for in the calculation of Z. Correlation coefficients were calculated for every site and sex and were estimated with the age-standardized rates from 1983 to 1991, because for previous years data quality was not sufficiently reliable.

Average Annual Percent Change (AAPC) in Cancer Incidence and Mortality

The AAPC values were calculated for each site by fitting a model that assumed a constant rate of change in the ASIRs or ASMRs, that is, a linear model applied to the ASIRs and ASMRs after logarithmic transformation. The estimated resulting slope of that model was then transformed back to represent a percentage increase or decrease.

Data from 1984 to 1991 were used for incidence, and data from 1984 to 1993 for mortality. These series were long enough to create estimates of AAPCs that were both reliable and current and were also consistent with the time period of the data series used in the estimation of counts and age-standardized rates.

Probability of Developing/Dying from Cancer

Probabilities were calculated based on the age- and sex-specific cancer incidence and mortality rates for Canada in 1991, and on life tables based on 1990-1992 all cause mortality rates. The methodology used was that of Zdeb³³ and Seidman.²⁴ The life table procedures used assumed that the rate of cancer incidence for various age groups in a given chronological period will prevail throughout the future lifetime of a person as he/she advances in age. Since these may not be the rates that will prevail at the time a given age is attained, the probabilities should be regarded only as approximations of the actual ones.

The probability of dying from cancer represents the proportion of persons dying from cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 1993. The indicator was calculated by determining the proportion of deaths attributed to specific types of cancer for each sex and age group, multiplying this proportion by the corresponding number of deaths in the life table, summing the life table deaths over all sex and age groups, and dividing by the number of survivors at birth to obtain the probability of dying from each cause.

Potential Years of Life Lost

The indicator was calculated by obtaining deaths for ages <1, 1-4, 5-9,..., 90+ for Canada in 1993, and life expectancy at the midpoints of the age groups. The PYLL is the total number of years of life lost obtained by multiplying, for each age group, the number of deaths by the life expectancy of survivors.²³

Childhood Cancer

The classification system used to record the occurrence of childhood cancer in this publication is that developed by the International Agency for Research on Cancer, and is a modification of the Manchester system for the classification of childhood cancer.²² Appropriately for the childhood cancers, this classification system places greater emphasis on the morphology of the tumours than the ICD classification system, which emphasizes topography. In this system, the category "lymphomas" includes: Hodgkin's disease, non-Hodgkin's lymphoma, and other lymphomas which comprise Burkett's lymphoma, Histiocytosis X, unspecified lymphomas, and other reticuloendothelial neoplasms.

Direct Costs of Cancer in Canada, 1993

The Health Canada report *National Health Expenditures in Canada, 1975-1993* provided the total national expenditure for hospitals and other institutions, physicians and other health professionals, capital, and other expenditures.⁹ To determine the breakdown of hospital and physician expenditures by disease category, the 1991/92 Manitoba distribution of physician costs and the Canadian Institute for Health Information (CIHI) distribution of 1993 total resource intensity weights (RIWs) were multiplied by the 1993 national expenditures, respectively. Canadian drug costs to the consumer were estimated using the three medical audits produced by Intercontinental Medical Statistics (IMS) Canada, 1993 (i.e., Canadian Pharmaceutical Market: Drug Store and Hospital Purchases (CDH), Canadian Disease and Therapeutic Index: Diagnosis (CDTI) and Canadian Compuscript (CS)). The Reference List of Health Research in Canada, 1993-94 by the Medical Research Council of Canada was reviewed to determine the total research cost by disease category. The estimate of research cost was based on funding by the NCIC, the Medical Research Council, the National Health Research and Development program, as well as provincial cancer boards and registries and other granting agencies.

APPENDIX II: ACTUAL DATA FOR NEW CASES AND DEATHS

Table 1
New Cases of Cancer by Site and Sex, Canada, 1991

Site	ICD-9	Total	Males	Females
All cancer sites	140-208	109,442	57,780	51,662
Oral (Buccal cavity and pharynx)	140-149	3,017	2,195	822
Lip	140	733	604	129
Tongue	141	516	377	139
Salivary gland	142	246	140	106
Floor of Mouth	144	233	175	58
Pharynx	146,147,148	745	559	186
Other and unspecified	143,145,149	544	340	204
Digestive organs	150-159	23,886	13,025	10,861
Esophagus	150	1,065	730	335
Stomach	151	2,943	1,904	1,039
Small intestine	152	314	177	137
Large intestine	153	9,740	4,814	4,960
Rectum	154	4,790	2,850	1,940
Liver and billiary passages	155,156	1,683	898	785
Pancreas	157	2,716	1,386	1,330
Other and unspecified	158,159	601	266	335
Respiratory system	160-165	18,918	12,769	6,149
Larynx	161	1,323	1,079	244
Lung	162	17,027	11,288	5,739
Other and unspecified	160,163-165	568	402	166
Bone tissue and skin	170-172	3,469	1,727	1,742
Bone	170	313	178	135
Connective Tissue	171	682	357	325
Skin (melanoma)	172	2,474	1,192	1,282
Breast	174,175	15,195	108	15,087
Genital organs	179-187	20,789	14,049	6,740
Cervix	180	1,403	...	1,403
Body of uterus	182	2,748	...	2,748
Ovary	183	2,049	...	2,049
Prostate	185	13,292	13,292	...
Other and unspecified	179,181,184,186,187	1,297	757	540
Urinary organs	188-189	7,541	5,201	2,340
Bladder	188	4,418	3,282	1,136
Kidney and other urinary	189	3,123	1,919	1,204
Eye	190	263	157	106
Brain and central nervous system	191-192	2,025	1,145	880
Endocrine glands	193-194	1,320	398	922
Thyroid	193	1,165	317	848
Other endocrine	194	155	81	74
Leukemia	204-208	3,083	1,767	1,316
Other blood and lymph tissues	200-203	6,205	3,349	2,856
Hodgkin's disease	201	792	447	345
Multiple myeloma	203	1,257	661	596
Other lymphomas	200, 202	4,156	2,241	1,915
All other and unspecifled sites	195-199	3,731	1,890	1,841

Note: ICD-9 refers to the Ninth Revision of the International Classification of Diseases. Figures include data from Yukon and Northwest Territories and exclude non-melanoma skin cancer (ICD-9 173).

... Not applicable.

Source: Health Statistics Division, Statistics Canada.

Table 2
Cancer Deaths by Site and Sex, Canada, 1993

Site	ICD-9	Total	Males	Females
All cancer sites	140-208	56,144	30,443	25,701
Oral (Buccal cavity and pharynx)	140-149	995	723	272
Lip	140	20	14	6
Tongue	141	244	176	68
Salivary gland	142	58	39	19
Floor of Mouth	144	51	37	14
Pharynx	146,147,148	290	222	68
Other and unspecified	143,145,149	332	235	97
Digestive organs	150-159	15,060	8,100	6,960
Esophagus	150	1,135	797	338
Stomach	151	1,997	1,216	781
Small intestine	152	114	60	54
Large intestine	153	4,547	2,277	2,270
Rectum	154	1,411	818	593
Liver and biliary passages	155,156	1,536	814	722
Pancreas	157	2,818	1,408	1,410
Other and unspecified	158,159	1,502	710	792
Respiratory system	160-165	15,840	10,546	5,294
Larynx	161	498	412	86
Lung	162	15,155	10,012	5,143
Other and unspecified	160,163-165	187	122	65
Bone tissue and skin	170-172	986	538	448
Bone	170	152	83	69
Connective Tissue	171	269	131	138
Skin (melanoma)	172	565	324	241
Breast	174,175	4,832	42	4,790
Genital organs	179-187	6,048	3,645	2,403
Cervix	180	413	...	413
Body of uterus	182	305	...	305
Ovary	183	1,305	...	1,305
Prostate	185	3,587	3,587	...
Other and unspecified	179,181,184,186,187	438	58	380
Urinary organs	188-189	2,479	1,634	845
Bladder	188	1,265	875	390
Kidney and other urinary	189	1,214	759	455
Eye	190	33	18	15
Brain and central nervous system	191-192	1,325	757	568
Endocrine glands	193-194	230	84	146
Thyroid	193	151	50	101
Other endocrine	194	79	34	45
Leukemia	204-208	1,949	1,087	862
Other blood and lymph tissues	200-203	3,074	1,593	1,481
Hodgkin's disease	201	163	91	72
Multiple myeloma	203	999	511	488
Other lymphomas	200, 202	1,912	991	921
All other and unspecified sites	195-199	3,293	1,676	1,617

Note: ICD-9 refers to the Ninth Revision of the International Classification of Diseases. Figures include data from Yukon and Northwest Territories and exclude non-melanoma skin cancer (ICD-9 173).

... Not applicable.

Source: Health Statistics Division, Statistics Canada.

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FOR FURTHER INFORMATION

For general information regarding cancer statistics or any other aspect of cancer (such as cancer prevention, screening, diagnosis, treatment and care, etc.), contact the **Canadian Cancer Society (CCS)**. A list of the offices of the CCS - the National Office and the Divisional offices - is provided on page 83. Your local CCS office is listed in the white pages of the telephone directory.

For information regarding cancer research sponsored by the **National Cancer Institute of Canada (NCIC)**, with funds provided by the CCS and the Terry Fox Foundation, contact the National Office of the NCIC at the address listed on page 83.

Information on risk assessment and surveillance in the epidemiology of cancer is available from the Director, Cancer Bureau, **Health Canada**, Tunney's Pasture, Ottawa, Ontario, K1A 0L2. Tel. (613) 957-0327; FAX (613) 941-2057.

Detailed Standard Tables or custom tabulations are available on a cost recovery basis upon request from Statistics Canada Reference Centres or the Health Statistics Division, **Statistics Canada**. Information on cancer incidence and mortality can be obtained annually from *Cancer in Canada, Catalogue 82-218*. Also, hospital statistics on cancer can be obtained from *Hospital Morbidity, Catalogue 82-216*. Analytical articles appear regularly in *Health Reports, Statistics Canada, Catalogue 82-003, Quarterly*.

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